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Physics Abstracts

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PHYSICS ABSTRACTS

Volume 59 OCTOBER 1956 Number 706

MATHEMATICS 51

517.5 : 548.735

7098. A CONTRIBUTION TO THE HISTOGRAPHY OF FUNCTIONS, ESPECIALLY IN THE INVERSION OF THE COMPOSITION PRODUCT. M.Tournarie.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2509-12 (May 23, 1956). In French.

Various properties of histograms are developed, and the mathematical developments are useful in the theory of the X-ray analysis of crystal structure. See Proc. Phys. Soc., Vol. 48, 772-80 (Sept. 1, 1936) and Abstr. 4039 (1948).

L.S.Goddard

517.544.2

7099. DERIVATION OF THE FREE-SPACE SCALAR GREEN'S FUNCTION. D.H.Robey and D.H.Potts.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 723-4 (July, 1956).

The free-space Green's functions which satisfies the inhomogeneous scalar wave equation is derived by a simple and direct method. A.

518.2 : 621.37.01

7100. LAGUERRE FUNCTIONS: TABLES AND PROPERTIES. J.W.Head and W.P.Wilson.
Proc. Instn Elect. Engrs, Monogr. No. 183 R, publ. June, 1956 (Vol. 103 C, 428-40).

Republication of the monograph abstracted in Abstr. 5596 (1956).

518.5 : 681.142

7101. THE METHOD OF LANCZOS FOR CALCULATING THE CHARACTERISTIC ROOTS AND VECTORS OF A REAL SYMMETRIC MATRIX. R.A.Brooker and F.H.Sumner.
Proc. Instn Elect. Engrs, Paper No. 2017 M, publ. Feb., 1956 (Part B Suppl. No. 1, 114-19, 120-2).

Republication, with discussion, of the paper abstracted in Abstr. 1778 (1956).

518.5 : 621.374.32 : 681.142

7102. THE PROGRAMMING STRATEGY USED WITH THE MANCHESTER UNIVERSITY COMPUTER. R.A.Brooker.
Proc. Instn Elect. Engrs, Paper No. 2013 M, publ. March, 1956 (Part B Suppl. No. 1, 151-7, 163-4).

Republication, with discussion, of the paper abstracted in Abstr. 3436 (1956).

519.2

7103. THE LOGARITHMIC CORRELATION. M.Castañs Camargo and M.Medina e Isabel.
An. Real Soc. Españ. Fís. Quím., Vol. 52 (A), No. 5-6, 117-36 (May-June, 1956). In Spanish.

A new index of correlation between two discrete variables is defined. If the first variable falls into categories (i) with probabilities p_i and the second into categories (j) with probabilities q_j, while the probability of simultaneous occurrence of (i) and (j) is p_{ij}, this index is

$$r_0 = \sum_i \sum_j (p_{ij} \log p_{ij} - p_i q_j \log p_i q_j)$$

The logarithmic coefficient of correlation is defined as

$$-2r_0 \cdot \left(\sum_i \sum_j p_i q_j \log p_i q_j\right)^{-1},$$

and must lie in the interval $[0, 1]$. Some numerical examples are given, and properties of the new statistic are investigated.

N.L.Johnson

ASTRONOMY . ASTROPHYSICS . GEODESY 52

523.16

7104. ON A POSSIBLE INTERSTELLAR GALACTIC CORONA. L.Spitzer, Jr.
Astrophys. J., Vol. 124, No. 1, 20-34 (July, 1956).

The physical conditions in a possible interstellar galactic corona are analysed. Pressure equilibrium between such a rarefied, high-temperature gas and normal interstellar clouds would account for the existence of such clouds far from the galactic plane and would facilitate the equilibrium of spiral arms in the presence of strong magnetic fields. Observations of radio noise also suggest such a corona. At a temperature of 10^6 deg K, the electron density in the corona would be $5 \times 10^{-4}/cm^3$; the extension perpendicular to the galactic plane, 8000 parsec; the total number of electrons in a column perpendicular to the galactic plane, about $2 \times 10^{19}/cm^2$; the total mass, about 10^8 M ☉. The mean free path would be 4 parsec, but the radius of gyration even in a field of 10^{-15} gauss would be a small fraction of this. Such a corona is apparently not observable optically except by absorption measures shortward of 2000 A. Radiative cooling at 10^6 degrees would dissipate the assumed thermal energy in about 10^9 years. Cooling by conduction can apparently be ignored, especially since a chaotic magnetic field of only 10^{-15} gauss will sharply reduce the thermal conductivity. At 3×10^6 degrees, near the maximum value consistent with confinement by the Galaxy's gravitational field, radiative cooling is unimportant, and a corona at this temperature might be primeval. The energy source needed at the lower temperatures may be provided by material ejected at high speed from stars or possibly by compressional waves produced by the observed moving clouds. Condensation of cool matter from the corona may perhaps account for the formation of new spiral arms as the old ones dissipate. A.

523.45

7105. COLORS ON JUPITER. F.O.Rice.
J. chem. Phys., Vol. 24, No. 6, 1259 (June, 1956).

A table listing a number of new low-temperature reactive species which have been prepared and their properties is given. The conditions in Jupiter's atmosphere would favour the existence of some, at least, of these species and it is suggested that

the great variety of colours observed on Jupiter and implying chemical activity in its outer skin is due to their presence. W.Good

523.72

7106. A MODEL FOR THE SOLAR ENHANCED REGION AT CENTIMETER RANGE DERIVED FROM PARTIAL ECLIPSE OBSERVATIONS. T.Hatanaka, K.Akabane, F.Moriyama, H.Tanaka and T.Kakinuma.
Rep. Ionosphere Res. Japan, Vol. 9, No. 4, 195-204 (1955).

The partial eclipse of the sun on June 20, 1955, was observed at three stations in Japan, i.e. Kagoshima, Toyokawa and Tokyo, at frequencies ranging from 3000 Mc/s to 4000 Mc/s. At Kagoshima and Toyokawa the moon covered a large sunspot group in the sourthern hemisphere and a considerable amount of decrease in flux was observed, while at Mitaka the flux decreased by only a few %. The interferometric observation at Toyokawa isolated the variation in flux of the enhanced region. By combining the observed curves the location, the size and the brightness distribution of the enhanced region were derived. The observed size of the region is approximately 4'. The brightness temperature is of the order of 10^6 degrees but not uniform over the region. The limb brightening only at the equatorial zone is also suggested. A.

523.745 : 537.591.5

COSMIC-RAY NEUTRON INTENSITY INCREASE ASSOCIATED WITH SOLAR FLARE OF FEBRUARY 23, 1956. See Abstr. 6759

523.755 : 550.385

7107. SOLAR CORONA AND GEOMAGNETISM. M.Notuki, Y.Nakagomi and M.Fukatsu.
Rep. Ionosphere Res. Japan, Vol. 9, No. 4, 215-21 (1955).

Both coronal activity and geomagnetic disturbance seem as a whole to vary in the same sense as the general solar activity. But a negative correlation between the two phenomena is seen during the period near the minimum solar activity. The latitude of the active coronal centre appears to have fairly large influences on geomagnetic disturbance. The smaller the difference is between the heliocentric latitude of the active centre and that of the earth, the larger the effect seems to be. The active coronal region looks as if it had a strong shielding effect on the general outflow of corpuscles from the undisturbed areas of the sun and it may greatly concern the local sources of corpuscular streams. A.

523.877

7108. ON THE EQUILIBRIUM CONFIGURATION OF MAGNETIC STARS. J.De.
Z. Astrophys., Vol. 40, No. 1, 21-7 (1956).

The equilibrium configuration of a fluid star under the action of an azimuthal magnetic field produced by a current distribution within the star has been investigated. It is found that for finite conductivity the configuration is a prolate spheroid. For infinitely large conductivity higher-order boundary surfaces are possible. A.

523.877 : 534.222.2

PRODUCTION OF SHOCK WAVES AT STELLAR SURFACES. See Abstr. 6450

529.786

7109. STANDARDS OF TIME AND FREQUENCY. G.M.Clemence.
Science, Vol. 123, 567-73 (April 6, 1956).

The requirements from the astronomical point of view of a measure of time to be suitable as a standard are outlined, and the astronomical units of mass, time and distance are reviewed. The importance and measurement of ephemeris time (the measure of time which is independent of the equations of motion of celestial bodies); the precision of determinations of time, including recent advances; atomic standards of frequency; and the atomic unit of time, are discussed. The carbon clock depending on the radioactive decay of a carbon isotope is not suitable as a fundamental standard and atomic clocks though useful as secondary standards cannot be adopted as fundamental standards. It is suggested that the "second" be reserved for the astronomically defined second and the "essen" a new unit, having a fixed and invariable relation to the frequency of the caesium atom, be introduced so that frequencies in cycles/second and cycles/essen refer to the astronomical and atomic standards of time respectively. S.Weintroub

PHYSICS 53

FUNDAMENTALS 530.1

530.12

7110. UNIFIED THEORY AND ELECTROMAGNETISM IN MATTER. F.Maurer-Tison.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3042-5 (June 25, 1956). In French.

Certain results on characteristic varieties due to Lichnerowicz are applied in a discussion of the propagation of electromagnetic waves in unified field theory. R.A.Newing

530.12

7111. ON THE PHYSICAL INTERPRETATION OF P.JORDAN'S EXTENDED THEORY OF GRAVITATION. M.Fierz.
Helv. phys. Acta, Vol. 29, No. 2, 128-34 (1956). In German.

It is noted that the variational principle with Langrangian $J^{\alpha}(R - \lambda J^{-2} J_{|\mu} J^{|\mu})$ leaves the 4-space metric undetermined to the extent of the conformal transformation $g^{*}_{ik} = \phi^{2}(\kappa) g_{ik}$, where ϕ is an arbitrary function and $\kappa = J^{\alpha+1/2}$. This ambiguity may be removed by the requirement that the path of an uncharged particle shall be a geodesic. An equivalent result follows by introducing a scalar matter field with the requirement that the Compton wavelength shall provide a natural distance scale. It is shown that the gravitational constant, defined as the ratio of gravitational and inertial masses, must be proportional to $\phi^{2}(\kappa)/\kappa$, Jordan's identification being a particular case of this. It is further noted that if $\alpha \neq -3/2$, the dielectric constant in vacuo will vary with κ and so also will the Bohr radius and the wavelengths of spectral lines. R.A.Newing

530.12

7112. THE STRENGTH OF THE FIELD EQUATIONS. F.E.Mauger.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1494-5 (June, 1956).

Einstein's number D_n has been used in evaluating the strengths of certain covariant systems, but it is now noted that D_1 is not equal to the number of restrictions that may be applied to the first derivatives of $g_{\mu\nu}$ at a point. The number $B_n = 4\binom{4}{n+1} = 4(n+4)!/3!(n+1)!$ is proposed in place of D_n. R.A.Newing

530.12

7113. ON EINSTEIN'S λ TRANSFORMATIONS. P.G.Bergmann.
Phys. Rev., Vol. 103, No. 3, 780-1 (Aug. 1, 1956).

The invariance of the curvature with respect to λ transformations is given a geometric significance that permits its immediate extension to more general curvatures. A.

530.12 : 538.3

ON THE ELECTRODYNAMICS OF MOVING BODIES BASED ON THE METRIC OF FOUR-SPACE. See Abstr. 6792

530.145

7114. ON THE INTEGRALS OF DE BROGLIE'S ELECTROMAGNETIC EQUATIONS. I. A.Tonolo.
C.R. Acad. Sci. (Paris), Vol. 242, No. 22, 2626-9 (May 28, 1956). In French.

530.145

7115. ON THE THEORY OF NON-LINEAR RELATIVISTICALLY INVARIANT EQUATIONS. G.A.Sokolik.
Dokl. Akad. Nauk SSSR, Vol. 101, No. 5, 815-20 (1955). In Russian.

530.145

7116. THE CLASSIFICATION OF NON-LINEAR EQUATIONS AND RELATIVISTICALLY INVARIANT INTERACTIONS BY REPRESENTATIONS OF THE LORENTZ GROUP, AND THE THEORY OF FUSION. G.A.Sokolik
Dokl. Akad. Nauk SSSR, Vol. 106, No. 3, 429-32 (1956). In Russian.

On the basis of previous work (see preceding abstract and Abstr. 3435/1955) it is shown by way of example that a non-linear Dirac equation with a source, and also the coupled equations for a Dirac field interacting with a Proca field, may be written in functional form. De Broglie's theory of fusion (Théorie Générale des Particules à Spin, 1948) is discussed, and it is pointed out that fusion may not give rise to a unique equation. J.M.Radcliffe

530.145

7117. EIGENFUNCTIONS AND PROPERTIES OF PATHOLOGICAL STATES IN FIELD THEORY. E.Arnous.
J. Phys. Radium, Vol. 17, No. 4, 374-5 (April, 1956). In French.

In Wentzel's model field theory the Hamiltonian has terms of the type $H = \frac{1}{2}(P^2 - \omega^2 Q^2)$, with $\omega^2 > 0$. By explicit construction it is shown that the corresponding eigenfunctions are not normalizable, and that the set with real eigenvalues is not complete and has no minimum energy. J.S.Bell

530.145

7118. CANONICAL TRANSFORMATIONS AND COMMUTATORS IN THE LAGRANGIAN FORMALISM. P.G.Bergmann, I.Goldberg, A.Janis and E.Newman.
Phys. Rev., Vol. 103, No. 3, 807-13 (Aug. 1, 1956).

A number of questions are clarified connected with the Lagrangian formulation of canonical transformations and commutator brackets. A distinction is made between "regular" and "singular" theories, the latter having such a structure that the Euler equations cannot be solved uniquely with respect to the accelerations. For "regular" theories it is shown that the introduction of the Poisson bracket by Peierls, which is based on a variation of the Lagrangian, and the infinitesimal canonical transformations introduced by Bergmann and Schiller lead to equivalent results. For "singular" theories it is shown first that constants of the motion do not necessarily generate invariant transformations and that, generally speaking, the relationship between transformations and generators is not unique in either direction. It is then shown that by restriction to invariant transformations and their generators, commutators between constants of the motion can be defined unambiguously. The resulting bracket expressions vanish whenever at least one of the commuted constants of the motion vanishes (is a secondary constraint). It turns out that these commutator brackets in the Lagrangian formalism are equivalent not to Poisson brackets but to (generalized) Dirac brackets. A possible quantization procedure is sketched in the concluding section. A.

530.145

7119. ON A REGULAR FORMULATION OF QUANTUM FIELD THEORY. I. NON RELATIVISTIC THEORY. K.Gotô.
Progr. theor. Phys., Vol. 15, No. 2, 167-77 (Feb., 1956).

A method of regular formulation of non-relativistic quantum field theory is presented, using well defined regular quantities and rigorous analysis only. A.

530.145

7120. SOLUTION OF SCHWINGER'S EQUATION FOR THE BLOCH–NORDSIECK MODEL. R.V.Tevikyan.
Zh. éksper. teor. Fiz., Vol. 30, No.5, 949-51 (1956). In Russian.

The integro-differential variational equations of Schwinger are solved after the replacement of the Dirac γ^α matrices by c-numbers u^α. G.E.Brown

530.145

7121. MULTILINEAR ALGEBRA AND THE QUANTIZATION OF THE DIRAC FIELD. D.Kastler.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2805-8 (June 11, 1956). In French.

530.145

7122. FIRST-ORDER VACUUM POLARIZABILITY FROM THE PRINCIPLE OF CAUSALITY. R.N.Euwema and J.A.Wheeler.
Phys. Rev., Vol. 103, No. 3, 803-6 (Aug. 1, 1956).

A driving current induces in the vacuum a response current, but the response must not precede its cause. This application of the principle of causality enables one to derive the Pauli–Rose result for first-order vacuum polarization from the most elementary calculation in quantum electrodynamics: the absorption of a single photon (with $-k_\alpha k^\alpha > 4k_m^2$) by a negative-energy electron. This calculation is also given. A.

530.145 : 530.162

7123. UNCERTAINTY RELATION AND FLUCTUATION THEORY. A.A.Sokolov and V.S.Tumanov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 802-3 (1956). In Russian.

Quantum effects are connected with vacuum fluctuations of the electromagnetic field calculated in a semi-classical manner. G.E.Brown

530.145

7124. THE SUMMIT (VERTEX) PORTION IN SCALAR ELECTRODYNAMICS IN THE REGION OF LARGE IMPULSES. A.A.Logunov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 2, 223-5 (1956). In Russian.

The method used is that originally due to Logunov (Abstr. 2643/1956). An approximate formula is developed in terms of simple exponential functions. S.C.Dunn

530.145

7125. THE MASS OF THE PHOTON IN QUANTUM ELECTRODYNAMICS. D.A.Kirzhnits.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 796-7 (1956). In Russian.

A three-point form factor is employed in the Lagrangian to smear out the electron-photon interaction. The requirement of zero photon mass in the limit as the cut off goes to infinity produces a contradiction; thus this way of making the theory finite runs into serious difficulties. G.E.Brown

530.145

7126. VANISHING OF RENORMALIZED CHARGES IN FIELD THEORIES WITH POINT INTERACTION.
I.Ya.Pomeranchuk, V.V.Sudakov and K.A.Ter-Martirosyan.
Phys. Rev., Vol. 103, No. 3, 784-802 (Aug. 1, 1956).

A short survey of the results obtained by applying the theory of Landau, Abrikosov and Khalatnikov to pseudoscalar

meson theory is presented. An independent deduction of the explicit expressions for the Green's functions and vertex part is obtained on the basis of simple renormalizability considerations. The relation thus obtained between g_0^2, g_c^2 and the momentum cutoff Λ is such that the theory inevitably leads to the result that for point interaction (i.e. in the limit $\Lambda \to \infty$) the renormalized charge g_c must equal zero. It is shown that if two cutoffs Λ_p and Λ_k (corresponding to the nuclear and meson momenta) are introduced, this result can rigorously be proved for any value of g_0^2, provided that the limits are moved apart sufficiently rapidly when $\Lambda_k \to \infty$. In the course of the proof an estimation is made of the terms neglected in the zero approximation in the vertex part equation, these terms corresponding to diagrams with intersecting meson lines and nucleon loops. It is shown that for two different ways of carrying out the limiting process, namely,

(a) for $\Lambda_k \to \infty$, and $[\ln(\Lambda_k^2/m^2)][\ln(\Lambda_p^2/\Lambda_k^2)]^{-1} \ll 1$,

(b) for $\Lambda_k \to \infty$, and only $[\ln(\Lambda_p^2/\Lambda_k^2)]^{-1} \ll 1$,

the contribution of these diagrams is vanishingly small for any g_0^2. In the second case, the contributions from an infinite set of meson–meson scattering diagrams are summed and it is found that the total contribution is of the same order as that from the simplest diagrams of this process. The theory with pseudovector coupling, which is not renormalizable when expanded into the usual perturbation theory series, is also considered. It is shown that renormalization can be carried out without expanding into a series; the renormalized charge in this case also vanishes. This result has been rigorously obtained only for a special type of limiting process $\Lambda_k \to \infty$, namely if the inequality

$$(c)\ \Lambda_k^2/m^2[\ln(\Lambda_p^2/\Lambda_k^2)]^{-1} \ll 1$$

is obeyed. In conclusion, a short discussion on the possibility of an experimental proof of the inconsistency of field theory is presented. A.

530.145

7127. RADIATIVE CORRECTION TO THE MAGNETIC MOMENT OF THE μ-MESON. V.B.Berestetskiĭ, O.N.Krokhin and A.K.Khlebnikov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 788-9 (1956). In Russian.

The vertex part is calculated in the Feynman formalism. G.E.Brown

530.145

7128. ON THE SINGULARITY OF THE ELECTROMAGNETIC POTENTIAL IN HIGHER APPROXIMATIONS OF PERTURBATION THEORY. Yu.M.Lomsadze.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 707-12 (1956). In Russian.

It is shown that a singularity at zero of the electromagnetic interaction potential between two electrons (or an electron and a positron) does not exceed $(1/r)\ln^{(n-2)/2}r$ in any arbitrarily high (n-th power of the charge) approximation of the perturbation theory. A.

530.145

7129. RENORMALIZABILITY OF PSEUDOSCALAR MESON THEORY WITH PSEUDOVECTOR COUPLING. E.N.Avrorin and E.S.Fradkin.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 756-60 (1956). In Russian.

It is shown that the convergence of pseudoscalar theory with pseudovector coupling does not improve even when the corrections accounting for vacuum polarization are introduced in the meson propagation function. A.

530.145

7130. STRANGE PARTICLES AND THE CONSERVATION OF ISOTOPIC SPIN. A.Gamba.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1486-7 (June, 1956).

With reference to the investigation of Case, Karplus and Yang (Abstr. 1851/1956), it is shown that, for example, any process involving one nucleon and one pion must be either charge dependent or charge independent with respect to the full group. P.T.Matthews

530.145

7131. ANNIHILATION OF ANTINUCLEONS. G.Sudarshan.
Phys. Rev., Vol. 103, No. 3, 777-9 (Aug. 1, 1956).

The expected π^- and K-meson multiplicities resulting from the annihilation of a nucleon pair at rest have been calculated on the basis of two versions of the statistical theory: the Fermi and the Pomeranchuk–Landau models. The Fermi model yields smaller pion multiplicities and larger probabilities for K-meson pairs than does the Pomeranchuk–Landau model. A.

530.145

7132. GREEN'S FUNCTION OF CHARGED PARTICLES IN THE REGION OF THE INFRA-RED CATASTROPHE. L.P.Gor'kov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 790-1 (1956). In Russian.

Starting from the non-relativistic equation, the Green's function for propagation of an "almost-real" particle in an electromagnetic field is constructed, and the appearance of an added singularity in this region is demonstrated for a particle of arbitrary spin. G.E.Brown

530.145

7133. RELATIVISTIC SPHERICAL FUNCTIONS. A.Z.Dolginov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 746-55 (1956). In Russian.

Finite-dimensional representations of rotation groups in four-dimensional pseudo-Euclidian and Euclidian spaces are considered. Basis group functions are constructed which are the eigenfunctions of the four-dimensional angular momentum operator. The expansion coefficients of the Klebsch–Jordan series are calculated. Spinor functions satisfying the four-dimensional angular momentum operator with a spin are determined. The possibility of separating the variables in the relativistic two-body problem is briefly discussed. A.

530.145 : 537.123

7134. ONE-MESON AND NO-MESON ANNIHILATION OF ANTINUCLEONS. B.M.Pontekorvo (Pontecorvo).
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 947-8 (1956). In Russian.

Processes of the type $\tilde{p} + d \rightleftharpoons \pi^- + p$ and $\tilde{p} + H^3 \rightleftharpoons d + \pi^-$, where $\tilde{p}$ is an antiproton, are considered, especially from the standpoint of charge independence. G.E.Brown

530.145

7135. REMARKS ON THE RELATIVISTIC TWO BODY PROBLEM IN THE CLASSICAL SCALAR MESON FIELD THEORY. J.Plebański and J.Sawicki.
Acta phys. Polon., Vol. 14, No. 6, 455-70 (1955).

Some general remarks are given on the Cauchy problem for the system scalar meson field + particles. An exact solution of the two-body problem in the case of a circular motion is found for $\mu = 0$. This solution is compared with the solutions in the case of some different approximations. The rectilinear motion related to the problem of the repulsive forces for small distances between the nucleons in the scalar field theory is discussed. It is shown that some physical contradictions result from the theory if retardation is neglected. A.

530.145 : 539.18

7136. ON THE NUCLEAR INTERACTIONS OF RELATIVISTIC MU MESONS. D.Kessler and P.Kessler.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3045-7 (June 25, 1956). In French.

By the Weizäcker–Williams method cross-sections for processes induced by mu mesons have been simply related to corresponding cross-sections with photons. An essentially

equivalent result is here obtained from field theory.
J.S.Bell

530.145

7137. A NEW TYPE OF RELATIVISTICALLY INVARIANT LINEAR LOCALIZED FIELD EQUATIONS. R.S.Ingarden.
Dok. Akad. Nauk SSSR, Vol. 108, No. 1, 56-9 (1956). In Russian.

The author proposes a wave equation where the coefficients depend on the distance of two points in 4-space; the equation is homogeneous except for vanishing distance between the two points where by means of delta functions, an inhomogeneity is introduced. Simple solutions of the equation are possible in terms of Laguerre polynomials. Solutions corresponding to a point source are obtained by expansions in Laguerre polynomials. The Yukawa potential appears to be a solution of the author's wave equation. R.Eisenschitz

530.145

7138. THEORY OF HYPERONS. R.S.Ingarden.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 951-3 (1956). In Russian.

Hyperons are viewed as a two-particle structure bound together by a potential, which is chosen here as the potential from a general equation investigated before (see preceding abstract) although this equation is not employed because it does not lead to discrete states. Instead, the potential is put into a Klein–Gordon equation. G.E.Brown

530.145

7139. SOME CONSIDERATIONS ON THE CHARGE-EXCHANGE SCATTERING OF ANTINUCLEONS ON NUCLEONS. D.Amati and B.Vitale.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 145-6 (July, 1956).

The ratio of the various types of nucleon–antinucleon scattering is determined on the assumption that one or other of the possible isotopic spin states dominates. A dominance of the T = 0 state is suggested by perturbation theory applied to ps–ps coupling. P.T.Matthews

530.145

7140. DETERMINATION OF THE p-WAVE COUPLING CONSTANT f^2 OF PION–NUCLEON SCATTERING FROM ANALYSIS OF THE α_{31} PHASE-SHIFT. A.Stanghellini.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 168-71 (July, 1956).

The coupling constant is determined by Chew–Low theory and found to be consistent with that found from the α_{33} phase-shift. P.T.Matthews

530.145

7141. GENERAL DISPERSION RELATIONS.
J.C.Polkinghorne.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 216-30 (Aug., 1956).

A formalism is developed whereby dispersion relations may be obtained for all meson–nucleon scattering processes, including those in which mesons are created or destroyed. A suitable kinematical description of the processes is first given and a new amplitude is defined in terms of it. This amplitude has two important properties. Firstly, it coincides with the Feynman amplitude for positive energies of the incoming and outgoing particles. Secondly it satisfies a certain causality condition. These enable one to obtain dispersion relations. The significance of these results in affording a new way of formulating quantum field theory is discussed. A.

530.145

7142. SCATTERING PROBLEMS IN FIELD THEORY.
A.Visconti and H.Umezawa.
Nuclear Physics, Vol. 1, No. 5, 335-47 (April, 1956).

An approximation procedure which starts from a reformulation of Fredholm's type of solution is given. Applications to S-matrix theory, to the theory of the reactance operator, to the determination of adiabatic nuclear potentials and to Heitler's integral equation are given. A.

530.145

7143. MESIC AND NUCLEONIC CONTRIBUTIONS TO THE ANOMALOUS MAGNETIC MOMENTS. A.Petermann.
Nuclear Physics, Vol. 1, No. 5, 355-6 (April, 1956).

A rule is given, enabling every term to be classified, without ambiguity, as "nucleonic" of "mesic" contribution. A.

530.145

7144. ON THE ANOMALOUS MAGNETIC MOMENTS.
A.Petermann.
Nuclear Physics, Vol. 1, No. 5, 357-9 (April, 1956).

An expression for the nucleonic (electronic) current contribution to the anomalous moment of the nucleon (electron) is derived from the general form of the Green's function. It is shown that these anomalous moments are related to the low energy limit of Compton-like scattering processes. The simplification for practical computations is evident. A.

530.145

7145. CROSSING SYMMETRY IN MESON–NUCLEON SCATTERING. G.Feldman and P.T.Matthews.
Phys Rev., Vol. 102, No. 5, 1421-2 (June 1, 1956).

The crossing symmetry is a theorem which expresses that scattering amplitudes are unchanged when the incoming and outgoing meson four-momenta are reversed in sign. The authors show this to be an expression of the Bose statistics of the pions. The proof uses only symmetry operations like space-time reversal, charge conjugation, on the propagators of field theory. It is concluded that the symmetry should be preserved in any approximate but relativistic treatment of the scattering problem. H.Motz

530.145

7146. EXACT SUM RULES IN THE FIXED-SOURCE MESON THEORY. M.Cini and S.Fubini.
Phys. Rev., Vol. 102, No. 6, 1687-8 (June 15, 1956).

By a combination of exact sum rules and the experimental data, it is shown that the square-cut-off, one-meson, theory cannot be both selfconsistent, and in agreement with experiment, and that many meson states must contribute appreciably at high energies. P.T.Matthews

530.145

7147. RELATIVISTIC EFFECTS IN NUCLEAR FORCES.
H.P.Duerr.
Phys. Rev., Vol. 103, No. 2, 469-80 (July 15, 1956).

An attempt is made to reformulate in a relativistically invariant way a phenomenological theory proposed by Johnson and Teller. Such a generalized theory reproduces the earlier results, i.e., saturation of nuclear binding and approximately correct neutron-to-proton ratios. It also avoids the collapse of the nucleus occurring in the nonrelativistic theory for high kinetic energies. The theory predicts as a secondary result an extremely strong spin-orbit coupling which is of the order of magnitude of the phenomenological coupling introduced in the shell model. Furthermore, the theory predicts a strong attraction between nucleons and antinucleons. This could lead to a ^1S bound state as the ground state of the nucleon–antinucleon system having the properties of a pseudoscalar meson. The strong attraction between antinucleons and nuclear matter also suggests a high value for the collision cross-section of antiprotons with nuclei, an effect which has recently been observed. A.

530.145

7148. BORN APPROXIMATION IN A THREE-BODY SCATTERING PROBLEM. S.L.Schwebel.
Phys. Rev., Vol. 103, No. 3, 814-21 (Aug. 1, 1956).

A one-dimensional three-body scattering problem is constructed and solved exactly. The scattering amplitudes of the exact solution are compared with those obtained by the application of the Born approximation to the problem. The latter procedure is formulated in two distinct ways, using a symmet-

ric or asymmetric perturbation term. The results indicate that the method using symmetric perturbation is superior to that employing asymmetric perturbation, although it is more difficult mathematically. An approximation method is developed which yields results as accurate as those obtained from the symmetric perturbation and which is on the same mathematical plane of difficulty as the asymmetric perturbation scheme. Moreover, the procedure is applicable to actual physical problems and is particularly useful for the calculation of exchange scattering. A.

530.145

7149. CONTRIBUTION TO THE THEORY OF PRODUCTION AND ANNIHILATION OF ANTIPROTONS. L.M.Afrikyan.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 734-45 (1956). In Russian.

Creation of antiprotons by π-mesons colliding with nucleons is investigated within the framework of charge-invariant pseudoscalar meson theory. The cross-sections of the effects for energies in the threshold region are computed. It is shown that the interaction in the final state can lead to capture of antiprotons on deuteron-like orbits of the nucleons. This circumstance may give rise to difficulties when one attempts to detect antiprotons in the threshold energy region due to a high probability of capture and to the small lifetime of the antiproton bound state with respect to annihilation ($\tau \cong 10^{-21}$ sec). The formation of antiprotons in nucleon collisions is also considered. The cross-sections for these effects near the threshold value are computed taking into account the interaction between the created particles. A.

530.145

7150. A CRITICISM OF BOHR'S QUANTUM-MECHANICAL CONCEPTS. V.A.Fok (Fock).
Czech. J. Phys., Vol. 5, No. 4, 436-48 (Dec., 1955). In Russian.

A critical analysis of Bohr's quantum-mechanical concepts is given. It is pointed out that the extension of the concept of complementarity (as suggested by Bohr) is illegitimate; this concept can only be used in the sense of Heisenberg's relation limiting the possibility of a classical description. It is shown that the concept of an "uncontrollable interaction" must be abandoned as incorrect. The notion of the "middle" or "working" stage of the experiment is introduced; in this stage the object, prepared in a definite manner, remains in definite external conditions. The importance of this stage of experiment (not considered by Bohr) is emphasized. A modified definition of the notion of the quantum state of an object is proposed; this is meant as the state, independent of any observer and described by a wave-function permitting to calculate the probability of the given behaviour of an object under the given (potentially possible) external influence. A.

530.145

7151. ON THE TREATMENT OF TRIPLY DEGENERATE VIBRATIONS IN SPHERICAL COORDINATES. I.Gamo.
J. Phys. Radium, Vol. 17, No. 3, 312 (March, 1956). In French.

A short note on the expressions for the wave function of zero order and their use in deducing formulae for energy levels. L.S.Goddard

530.145

7152. TRANSITION AMPLITUDES AS SUMS OVER HISTORIES. W.Tobocman.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1213-29 (June, 1956).

Explicit sum over histories expressions for the transition amplitude are constructed on the basis of the canonical formalism of quantum mechanics. The sum over histories can be shown to coincide with the Feynman principle when the Hamiltonian is classical in form and quantization is carried out in terms of the commutators of operators. In general, the sum over histories differs somewhat from Feynman's functional integral but still involves the exponential of the action, $S = \int(px - H)dt$. However, for the Dirac field, where dynamical independence implies the anti-commutativity of operators, the sum over histories constructed has a form completely different from the Feynman principle. A

530.145

7153. AN EXPANSION FOR COULOMB WAVE FUNCTIONS. J.R.Shepanski and S.T.Butler.
Nuclear Physics, Vol. 1, No. 5, 313-21 (April, 1956).

An expansion for the regular radial Coulomb wave-functions, as suggested by an iteration procedure on the wave equation, is developed and found to be more rapidly convergent than the customary expansions. Few terms suffice to give good accuracy for radial distances less than, or of the order of, the position of the classical turning point. This is true for all values of the orbital angular momentum no matter how high. No similar expansion has yet been developed for the irregular Coulomb wave-functions. A

530.145

7154. COMMUTATION RELATIONS AND RELATIVISTIC WAVE EQUATIONS. H.Umezawa and A.Visconti.
Nuclear Physics, Vol. 1, No. 5, 348-54 (April, 1956).

Covariant commutation relations for particles of any spin are given in the cases where the particles have only one mass state or have a mass spectrum. A

530.145

7155. THE WAVE FUNCTIONS IN COULOMB FIELDS. A.S.Meligy.
Nuclear Physics, Vol. 1, No. 8, 610-18 (July, 1956).

A detailed mathematical study of the confluent hypergeometric functions is carried out. Exact analytic expansions in series of Bessel functions are developed. These expansions are found to be useful for the computation of the wave function in Coulomb fields. They have the advantage over power series expansions in the clearance of imaginaries from the wave functions for repulsive Coulomb fields. A

530.145

7156. REDUCTION OF RELATIVISTIC WAVE EQUATIONS AND THE "CONTACT INTERACTION". F.N.Glover and Z.V.Chraplyvy.
Phys. Rev., Vol. 103, No. 3, 821-4 (Aug. 1, 1956).

A new formulation of the large-component reduction method for one- and two-particle relativistic wave equations is presented and compared with the reduction procedure by the method of successive canonical transformations. Sufficient conditions are given for the identity, to the order $(1/c)^2$, of the energy spectra obtained by the two methods. The "contact interaction" term resulting from the latter procedure is shown to arise in the former as well, contrary to a statement by Wu and Tauber. A.

530.145

7157. INVARIANCE PROPERTY OF THE BRILLOUIN–WIGNER PERTURBATION SERIES. E.Feenberg.
Phys. Rev., Vol. 103, No. 4, 1116-19 (Aug. 15, 1956).

The complete perturbation series for the energy is invariant under the operation of adding a velocity-dependent interaction to the zeroth-order Hamiltonian and subtracting the same quantity from the perturbation operator. The same invariance property appears to hold also for an optimum formulation of the terminated energy series generated by the nth order approximation to the wave-function. An explicit proof is given for the first- and second-order wave-functions and also for the complete energy series. Variational procedures for determining (a) the optimum velocity dependence of the zeroth-order Hamiltonian and (b) the optimum uniform displacement of the zeroth-order energy spectrum are discussed in relation to the invariant formulations. A.

530.145

7158. DEGENERACY OF THE n-DIMENSIONAL, ISOTROPIC, HARMONIC OSCILLATOR. G.A.Baker, Jr.
Phys. Rev., Vol. 103, No. 4, 1119-20 (Aug. 15, 1956).

It is shown that what has previously been considered the "accidental" degeneracy in the energy levels of the n-dimensional, isotropic, harmonic oscillator is actually a consequence of its symmetry group. The additional symmetry, beyond the n-dimensional rotation group, arises from the symmetry between the coordinates and momenta. A.

530.145

7159. A NOTE ON NEUMANN'S PROOF. P.K.Feyerabend.
Z. Phys., Vol. 145, No. 4, 421-3 (1956). In German.

A criticism is raised against the proof of the impossibility of a deterministic interpretation of quantum mechanics (see v.Neumann, J. Mathematische Grundlagen der Quantenmechanik, Berlin, 1930). W.A.Hepner

530.162

7160. ON THE COLLECTIVE MOTION IN A SYSTEM OF PARTICLES HAVING DIFFERENT MASSES AND CHARGES. Z.Galasiewicz.
Acta phys. Polon., Vol. 14, No. 4, 373-5 (1955).

The work of Zubariew (Abstr. 754/1955) is generalized to a system having different masses and charges and used to calculate the binding energy of various metals. P.T.Matthews

530.162 : 536.7

7161. ON THE AXIOMATICS OF A NEW METHOD IN STATISTICAL MECHANICS. C.Marmasse.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2810-12 (June 11, 1956). In French.

A new method in statistical thermodynamics constructed in view of its applications in biophysics and based on the idea of function of distribution. An application to solutions of polyelectrolytes is described. F.E.Hoare

530.162

7162. FUNK–HECKE THEOREM IN RELATION TO THE TRANSPORT EQUATION. R.L.Liboff.
J. appl. Phys., Vol. 27, No. 6, 662-3 (June, 1956).

It is shown how the reduction of the source integral in Boltzmann's equation to an equivalent sum over surface harmonics is an immediate consequence of a theorem due to Funk (1916) and Hecke (1918). R.O.Davies

530.162

7163. RELAXATION OF VIBRATIONAL NONEQUILIBRIUM DISTRIBUTIONS. I. COLLISIONAL RELAXATION OF A SYSTEM OF HARMONIC OSCILLATORS. R.J.Rubin and K.E.Shuler.
J. chem. Phys., Vol. 25, No. 1, 59-67 (July, 1956).

A theoretical study has been made of the collisional relaxation of a system of harmonic oscillators prepared initially in a vibrational nonequilibrium distribution. Using harmonic oscillator collisional transition probabilities we have obtained expressions which describe the relaxation of initial nonequilibrium δ-function distributions and Boltzmann distributions to their final equilibrium state. Our results show that an initial Boltzmann distribution with "temperature" T_0 approaches the final equilibrium Boltzmann distribution at temperature T via a sequence of intermediate Boltzmann distributions with time-dependent "temperatures" $T_0 \geq T(t) \geq T$ for the case $T_0 > T$. The initial δ-function distribution relaxes to the final equilibrium Boltzmann distribution via a sequence of nonequilibrium distributions. The study of the relaxation of the mean energy shows that this relaxation depends only upon the mean energy of the initial distribution, and is independent of the form of the initial distribution. The relaxation time for the mean energy was found to be $1/k_{10}\theta$ where k_{10} is the collisional transition probability per second for transitions between levels one and zero and where $\theta = h\nu/kT$. The results obtained in this paper pertain to a system at sufficiently high pressure so that radiative transitions can be neglected as compared with collisional ones. A.

530.162

7164. RELAXATION OF VIBRATIONAL NONEQUILIBRIUM DISTRIBUTIONS. II. THE EFFECT OF THE COLLISIONAL TRANSITION PROBABILITIES ON THE RELAXATION BEHAVIOR. R.J.Rubin and K.E.Shuler.
J. chem. Phys., Vol. 25, No. 1, 68-74 (July, 1956).

In order to test the influence of the collisional transition probabilities on the relaxation behaviour of initial vibrational nonequilibrium distributions, we have used collisional transition probabilities which increase exponentially with an increase in the vibrational quantum number. The results obtained for this set of transition probabilities are compared with the results obtained for the Landau–Teller transition probabilities which increase linearly with an increase in the vibrational quantum number. Numerical calculations for the relaxation of various initial δ-function and Boltzmann distributions show that the detailed relaxation behaviour depends quite strongly on the form of the collisional transition probabilities. A.

530.162

7165. AN ANALYTICAL PROOF THAT THE EXTREMUM OF THE THERMODYNAMIC PROBABILITY IS A MAXIMUM. D.G.Miller.
J. phys. Chem., Vol. 60, No. 5, 536-9 (May, 1956).

An analytical proof is given that the distribution found by extremizing the thermodynamic probability actually is the most probable one. The cases considered are classical statistics, Bose–Einstein and Fermi–Dirac statistics, radiation and Wall's theory of rubber elasticity. In these examples, the proof depends only on the form of W. A.

530.162 : 530.145

7166. THE PROPERTIES OF THE QUANTUM-THEORETICAL DENSITY IN PHASE SPACE. H.Kümmel.
Nuovo Cimento (Ser. 10), Vol. 3, No. 5, 870-9 (May, 1956). In German.

The derivation of the classical equations of motion for the density in phase space (Abstr. 7733/1955 and 3507/1956) can be modified to take into account energy degeneracy. Furthermore, it can be shown that the density is almost everywhere positive. W.A.Hepner

530.162 : 536.7 : 548.7

7167. STATISTICAL MECHANICS OF IRREVERSIBLE PROCESSES. V. ANHARMONIC FORCES. R.Brout and I.Prigogine.
Physica, Vol. 22, No. 1, 35-47 (Jan., 1956).

For Pt IV see Abstr. 5232 (1955). A study of the mechanism by which the amplitudes of normal vibrations in a crystal approach asymptotically their equilibrium Gaussian distributions. An ensemble of systems is considered in which the normal amplitudes are random variables. The equations of motion include a small anharmonic term and the systems are taken to be large enough for the Poincaré period to be regarded as infinite. Assuming that initially the normal amplitudes are statistically independent with arbitrary distributions, it is shown that: (a) they remain so at times of order $1/\lambda^2$ (λ being the anharmonic interaction parameter); (b) the asymptotic form of each distribution is Gaussian; (c) the equation of Peierls for the rate of change of the second moments with time is maintained for all times. (Analogous equations for higher moments are established). The mathematical methods are similar to those used by Van Hove. (Abstr. 7706/1955). R.O.Davies

530.162 : 536.7 : 548.7

7168. STATISTICAL MECHANICS OF IRREVERSIBLE PROCESSES. VI. THERMAL CONDUCTIVITY OF CRYSTALS. R.Brout and I.Prigogine.
Physica, Vol. 22, No. 4, 263-72 (April, 1956).

It has been shown earlier (Abstr. 6492/1953) that local distribution functions in a crystal tend to a Gaussian form under purely harmonic forces in a time comparable with an inverse characteristic frequency. From this time onwards the approach to equilibrium is controlled by the anharmonic forces. It is here shown that making use of the harmonic "preparation", it is possible to develop a very simple theory of thermal conductivity. An explicit expression for the coefficient of thermal conductivity is obtained in terms of molecular quantities.
R.O.Davies

530.162 : 523.12

FURTHER DISCUSSION ON FLUCTUATIONS IN GRAVITATING SYSTEMS. See Abstr. 6296

530.162 : 537.311.1

RELAXATION FLUCTUATIONS IN CONDENSED SYSTEMS. See Abstr. 6618

530.162 : 538.561

FLUCTUATIONS IN OSCILLATING SYSTEMS OF THE THOMPSON TYPE. See Abstr. 6800-1

530.19

7169. REALIZABILITY, KRAMERS–KRONIG RELATIONS AND FUOSS–KIRKWOOD DIELECTRIC. H.Pelzer.
Physica, Vol. 22, No. 2, 103-8 (Feb., 1956).

A statement by Brachman and Macdonald (Abstr. 4133/1955) that the commonly accepted conditions of realizability are too stringent and are not fulfilled for the Fuoss–Kirkwood dielectric is not correct. On the other hand, the usual formulation could be somewhat amplified when dealing with an admittance function which is analytically multivalued. In this case only the principal value of the function has physical significance and the "lower sheets" of its Riemann surface are to be discarded (poles in them do not matter, even if they lie in a normally "forbidden" half plane) and the branch cuts become line singularities of a now univalued physical function. This is in line with the genesis of such functions from infinite continued fractions corresponding to a ladder structure. A.

530.19

7170. GENERALIZED IMMITTANCE KERNELS AND THE KRONIG–KRAMERS RELATIONS. M.K.Brachman and J.R.Macdonald.
Physica, Vol. 22, No. 3, 141-8 (March, 1956).

A general relation between the poles and residues of a Kronig–Kramers pair is established which enables one to prove that the generalized immittance kernel obtained as the solution of an Nth-order linear differential equation with constant coefficients and sinusoidal forcing must necessarily be consistent with the Kronig–Kramers relations. Finally, it is proved that the network or system function of a system exhibiting a distribution over any or all of the (N + 1) arbitrary parameters of the Nth-order immittance kernel must itself be consistent with the Kronig–Kramers relations. The example of Lorentz dispersion is discussed. A.

MECHANICAL MEASUREMENTS 531.7

531.717.1 : 535.33 : 537.531

7171. FILM THICKNESS BY X-RAY EMISSION SPECTROGRAPHY. H.A.Liebhafsky and P.D.Zemany.
Analyt. Chem., Vol. 28, No. 4(I), 455-9 (April, 1956).

When a polychromatic X-ray beam excites the characteristic line of an element in a thin film, the intensity of the line may increase with the thickness of the film, in which case a measurement of line intensity can be used to estimate the thickness. Owing to absorption of X-rays by the film, however, the relationship of intensity to thickness is not generally simple. This absorption filters and attenuates the polychromatic beam, and attenuates the characteristic line. As a consequence, the number of quanta per second contributed to the emergent beam by a layer of atoms decreases with the distance of the layer beneath the surface. Furthermore, quanta originating beyond a critical depth will have no measurable effect on the detector because not enough of them will reach it. For the measureme of film thickness by the method under discussion, this critical depth may be regarded as a critical thickness. A

531.717.3 : 621.317.39

7172. MEASUREMENT OF STRAIN ON ROTATING PARTS. THE INFLUENCE OF SLIP-RING COLLECTORS. J.Wachter.
VDI Z., Vol. 98, No. 3, 93-7 (Jan., 1956). In German.

The application of resistance strain gauges to rotating machine parts necessitates the use of slip-rings and brushes, or Hg troughs and amalgamated Cu disks. The effect on the measurements of noise voltages and thermo-e.m.f's produced by the contacts, and alterations of contact resistance and insulation resistance, are discussed. A number of curves show the resulting variations over periods up to 45 minutes, mostly at 3000 r.p.m. With suitably designed slip-rings, strain value of the order of 0.01% can be satisfactorily measured.
C.F.Pizzey

531.77

7173. AN INSTRUMENT FOR MEASURING THE CHANGES OF ANGULAR VELOCITY WITH AN ACCURACY OF 0.005% OF THE NOMINAL VALUE. V.Růžek.
Slaboproudý Obzor, Vol. 17, No. 5, 298-300 (1956). In Czech.

The measured angular velocity is converted into a frequency waveform by means of a phonic wheel which is attached to the shaft of the rotating machine. The resulting waveform is employed to modulate the amplitude of a crystal oscillator (60 kc/s). The modulated voltage is applied to an RC low-pass feedback filter which rejects the carrier (60 kc/s) and the upper sideband. The remaining signal is fed to a frequency discriminator whose output is zero at the nominal angular velocity. Changes of the velocity are indicated by the output voltages of the discriminator. R.S.Sidorowicz

MECHANICS OF FLUIDS 532

532.13 : 532.77 : 541.64

7174. INTRINSIC VISCOSITY (OF A POLYMER SOLUTION) AS A FUNCTION OF VELOCITY GRADIENT. II. M.Čopič.
J. Chim. phys., Vol. 53, 440-4 (May, 1956). In French.

Is derived for a flexible coil using the dumb-bell approximation, and taking account of the tensor character of the hydrodynamic interactions of the segments. The gradient dependence is due to the anisotropy of the interactions and it is unnecessary to postulate an "inner viscosity" as in Kuhn's theory (see Abstr. 4227/1956). The intrinsic viscosity decreases with increasing gradient and the deviations from the zero gradient value are proportional to the second power of the gradient, to a first approximation. A graph shows qualitative agreement between the theory and experimental data for polystyrene in benzene and in MEK. A limiting value of 25% of the zero gradient is predicted for the intrinsic viscosity and the gradient dependence is independent of the molecular weight of the polymer. The coefficients of diffusion are shown to be tensor quantities. G.Allen

532.51

7175. FLOW OF IMMISCIBLE FLUIDS IN POROUS MEDIA: EXACT SOLUTION OF A FREE BOUNDARY PROBLEM.
R.E.Kidder.
J. appl. Phys., Vol. 27, No. 8, 867-9 (Aug., 1956).

A mathematically exact solution is obtained of a two-

limensional free boundary problem arising in the flow of two mmiscible fluids in porous media. The particular problem lealt with concerns the "fingering" of water toward a line of equally-spaced oil wells that penetrate a thin, dipping sand. The solution is obtained by use of the hodograph plane and complex variable theory. A.

532.51 : 536.25

7176. THE FORCED FLOW DUE TO HEATING OF A ROTATING LIQUID. T.V.Davies.
Phil. Trans. A, Vol. 249, No. 958, 27-64 (1956).

An investigation is made of the forced liquid motion in a rotating cylindrical vessel with a horizontal base when a temperature difference exists between the outer and inner cylindrical boundaries of the liquid. It has been observed experimentally that at critical values of a certain non-dimensional parameter, known as the Rossby number, the flow patterns change abruptly in character. The present investigation derives a stability criterion which agrees qualitatively with the experimental results and also gives reasonable quantitative results. In the derivation of this result it is shown that the there exists a relation between the mean vertical temperature gradient, the mean horizontal temperature gradient and the angular velocity of rotation of the system. A.

532.517

7177. A SPHERE THEOREM ON THE STOKES EQUATION FOR AXISYMMETRIC VISCOUS FLOW. H.Hasimoto.
J. Phys. Soc. Japan, Vol. 11, No. 7, 793-7 (July, 1956).

A theorem is presented which gives the perturbation stream function $\tilde{\Psi}(r, \theta)$ when a sphere is introduced into an unlimited viscous fluid in axisymmetric motion obeying the Stokes equation, of which the stream function is $\Psi(r, \theta)$, where (r, θ, φ) are the polar coordinates. The method gives the stream sheets directly without recourse to manipulation of spherical harmonics, and is very simple when $\Psi(r, \theta)$ is irrotational. As examples of applications, the stream functions for uniform flow, source flow and parabolic flow past a sphere are derived. A.

532.517

7178. ON THE STEADY LAMINAR FLOW OF CERTAIN NON-NEWTONIAN LIQUIDS THROUGH AN ELASTIC TUBE. M.N.L.Narasimhan.
Proc. Indian. Acad. Sci. A, Vol. 43, No. 4, 237-46 (April, 1956).

A study of the effect of cross-viscosity on the radius of an elastic tube when certain highly viscous non-Newtonian liquids flow through it under pressure gradient. The effect is found to be of opposite nature to that of inertial and viscous forces and causes the radius of the tube to increase with the distance along the axis. A.

532.527

7179. A NEW LOOK AT THE REYNOLDS STRESSES IN TURBULENT SHEAR FLOWS. R.W.Stewart.
Canad. J. Phys., Vol. 34, No. 7, 722-5 (July, 1956).

The Reynolds stresses, in turbulent shear fluid flow, initiated by the work of Townsend, (The structure of turbulent shear flow, Cambridge University Press, 1955), are discussed in tensor form by application of the Navier—Stokes equation. These stresses are shown to express only the effect of anisotropy of the turbulence on the flow; mean velocity gradients imply mean rates of strain; the scale of turbulence is of no consequence so far as its effects on mean flow are concerned, and the Reynolds stresses are important only in that they express the amount and orientation of the anisotropy of the turbulence. J.S.G.Thomas

532.59 : 536.7

7180. ON THERMOELASTIC WAVES IN LIQUIDS. A.Carrelli and E.Grossetti.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1254-61 (June, 1956).

Investigates the thermomechanical properties of some liquids and solutions (water, glycerine, saturated solution of NaCl, saturated solution of Na_2SO_4) pointed out by R.Lucas (1937). The existence of the force predicted by Lucas has been confirmed with different methods which have yielded practically coincident results. It is underlined that the various methods employed are of different rapidity; an optical method which detects the thermal behaviour has shown that the latter proceeds practically in accord with the force measured. A.

CAPILLARITY 532.6

532.61 : 536.7

7181. THERMODYNAMIC INTERPRETATION OF THE EÖTVÖS CONSTANT. S.R.Palit.
Nature (London), Vol. 177, 1180 (June 23, 1956).

The formal similarity between the Eötvös equation $\gamma(Mu_{sp.})^{2/3} = K_E(T_C - T)$; ($\gamma$ = surface tension, M = molec. weight, $u_{sp.}$ = spec. volume, T_C = critical temp.) and the thermodynamic relation $\Delta F = \Delta H - T\Delta S$, is utilized to interpret the Eötvös constant K_E as a measure of the entropy of formation of a liquid surface. Thus the Eötvös equation appears as the liquid surface analogue of Trouton's law of vaporization. T.P.Brody

532.612.4 : 532.73

7182. ON THE SURFACE TENSION OF IDEAL SOLUTIONS. R.Mierzecki.
Acta phys. Polon., Vol. 14, No. 4, 365-7 (1955).

It is pointed out that experimental measurements of the surface tension of solutions are not sufficiently accurate to establish whether the surface tension is a linear function of concentration. Surface tension is influenced in a complicated way by association processes and so the results obtained experimentally do not apply to "ideal" solutions. The author puts forward a formula which represents the normal behaviour of surface tension as a function of concentration. This differs from that used in a recent paper by Puchalik (1954). J.Iball

532.612.4

7183. SURFACE TENSION OF IONIC SOLUTIONS. F.P.Buff and F.H.Stillinger, Jr.
J. chem. Phys., Vol. 25, No. 2, 312-18 (Aug., 1956).

As an illustration of the molecular theory of surface regions, the singlet and pair distribution functions are evaluated for very dilute ionic solutions. When they are substituted into the statistical mechanical formulae for surface tension, expressions are obtained for the increase in surface tension over that of the pure solvent. The results of the theory are in better agreement with experiment than the earlier calculation of Onsager and Samaras, which was based on integration of the Gibbs adsorption equation. Finally, the distribution function approach is simply related to Mayer's recent virial coefficient theory for strong electrolyte solutions. A.

532.613 : 536.7

7184. CURVED FLUID INTERFACES. I. THE GENERALIZED GIBBS—KELVIN EQUATION. F.P.Buff.
J. chem. Phys., Vol. 25, No. 1, 146-53 (July, 1956).

The properties of curved fluid interfaces in the presence of external fields are examined from the molecular point of view and are shown to imply a generalized Gibbs—Kelvin equation. These results are then related to Gibbs' phenomenological treatment and thus provide expressions for the relevant thermodynamic parameters in terms of the detailed properties of the transition zone. The formulation leads to an asymptotic estimate of the free energy and to corrections for the Laplace equation determining the shapes of interfaces. A.

532.62

7185. EXPERIMENTAL INVESTIGATION OF THE THICKNESS OF POLYMOLECULAR LAYERS OF AQUEOUS SOLUTIONS OF ELECTROLYTES ON GLASS AND QUARTZ AT THE INTERFACE WITH AIR. M.M.Kusakov and L.I.Mekenitskaya.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 4, 555-8 (1956). In Russian.

532.62

7186. EXPERIMENTAL INVESTIGATION OF THE THICKNESS OF POLYMOLECULAR LAYERS OF AQUEOUS SOLUTIONS OF ELECTROLYTES ON GLASS AND QUARTZ AT THE INTERFACE WITH A HYDROCARBON. M.M.Kusakov and L.I.Mekenitskaya.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 715-18 (1956). In Russian.

The thickness of the interfacial layer between an aqueous solution and a hydrocarbon in a capillary was determined by measurements of the electrical resistance. The time variation of the mean thickness of this layer has been followed for solutions of aluminium and potassium chlorides in contact with heptane and petroleum, in glass and quartz capillaries, and the effects of capillary radius, concentration of electrolyte, and presence of surface-active substances in the aqueous solution studied. The correlation between the equilibrium (final time-invariant) thickness of this layer on petroleum well water in contact with petroleum; and the interfacial tension was found: the thickness is zero between interfacial tensions of 18 and 28 ergs/sq.cm. R.C.Murray

532.64

7187. LIQUID METALS. IV. THE WETTING OF ZINC BY LIQUID SODIUM: THE SIGNIFICANCE OF THE CRITICAL WETTING TEMPERATURE. C.C.Addison, W.E.Addison, D.H.Kerridge and J.Lewis.
J. Chem. Soc., 1956, 1454-61 (June).

For Pt III, see Abstr. 3527 (1956). The wetting of metallic zinc by liquid sodium has been studied by measurement of contact angles over ranges of time and temperature. Electropolished zinc surfaces show a critical wetting temperature near 160°, and chemical reaction between sodium and the zinc phosphate film deposited during electropolishing is shown to be responsible for this. No critical wetting temperature is observed for abraded zinc plates. Rates and mechanisms of wetting are discussed from the point of view of diffusion through surface films of zinc phosphate and zinc oxide and the formation of the intermetallic compound $Zn_{13}Na$. The condition of the surface of zinc after wetting by sodium has been studied microscopically. A.

532.696.1 : 541.183

7188. WETTING OF COMMERCIAL POLYMETHYLMETHACRYLATE: ADSORPTION OF IONIZED AND NON-IONIZED LONG-CHAIN COMPOUNDS. L.Guastalla.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3074-7 (June 25, 1956). In French.

Adsorption curves for aqueous solutions of sodium lauryl sulphate, lauryl trimethyl ammonium bromide, un-ionized lauric acid and a straight chain C_7 alcohol on a thin sheet of polymethyl methacrylate are obtained from measurements of surface tension and adhesion tension, as a function of concentration (range 0.05×10^{-2} M to 1.5×10^{-2} M). The slopes of the curves indicate that whereas the ionizing solutes are adsorbed on immersion of the sheet, the reverse is the case for the non-ionized acid and alcohol. G.Allen

MOLECULAR THEORY OF LIQUIDS 532.7

532.72 : 536.445

7189. THERMAL DIFFUSION NEAR THE CRITICAL SOLUTION POINT. G.Thomaes.
J. chem. Phys., Vol. 25, No. 1, 32-3 (July, 1956).

Thermal diffusion measurements have been carried out near the critical solution point by means of a new apparatus which will be described in another paper. The Soret coefficient D'/D for nitrobenzene + n-hexane shows a large increase in the vicinity of this point. This is a strong argument in favour of the existence of a thermodynamical factor in the isothermal diffusion coefficient as predicted by the thermodynamics of irreversible processes. A

532.7

7190. DETERMINATION OF DIFFUSIVITIES IN LIQUID METALS BY MEANS OF TEMPERATURE-GRADIENT ZONE MELTING. J.H.Wernick.
J. chem. Phys., Vol. 25, No. 1, 47-9 (July, 1956).

Diffusivities of liquid alloys of Ge-Al, Ge-Au, and Si-Al have been measured by a new technique. Called temperature-gradient zone melting, the technique involves passing extremely thin molten zones through a solid crystal by means of a temperature gradient. Preliminary values of the diffusivities fall in the 10^{-5} cm^2/sec range at temperatures of 530° C to 700° C. A

532.72 : 533.15

7191. TREATMENT OF THE EQUATIONS OF CLASSICAL DIFFUSION IN HOMOGENEOUS ISOTROPIC MEDIA. D.G.O'Sullivan.
J. chem. Phys., Vol. 25, No. 2, 270-4 (Aug., 1956).

A method is described which utilizes a generalized convolution to produce simplification of the equations of a wide range of classical diffusion processes. The resulting transformation expresses the solutions to these equations in terms of solutions for much simpler problems, many of the latter being already available in textbooks. Demonstrations are given of the use of this method in the facile development of the required concentration mappings for certain systems. A

532.72

7192. THERMAL DIFFUSION IN LIQUID METALS. F.R.Winter and H.G.Drickamer.
J. phys. Chem., Vol. 59, No. 12, 1229-30 (Dec., 1955).

Measurements have been made on a series of liquid metal mixtures. The results are totally consistent with a previously presented theory. The separations depend on the "activation energy density" $\Delta U \neq /V$ of the components. It is also shown that the quantity $X(\partial\mu/\partial X)$ in the denominator is important for quantitative prediction of the separation. Result also are presented and discussed for three ternary mixtures. A.

532.72

7193. SELF-DIFFUSION IN LIQUIDS. I. CONCENTRATION DEPENDENCE IN IDEAL AND NON-IDEAL BINARY SOLUTIONS. P.A.Johnson and A.L.Babb.
J. phys. Chem., Vol. 60, No. 1, 14-19 (Jan., 1956).

A capillary diffusion-cell technique combined with radioactivity measurements has been used to measure self-diffusion rates in ideal and non-ideal binary liquid mixtures at 25° with an accuracy of 5%. In the ideal systems studied there was a generally linear variation of the self-diffusion coefficient with molar composition and the values for mutual and self-diffusion agreed within 10% over the entire composition range. In the non-ideal systems, however, the self-diffusion coefficient differed from the mutual diffusion coefficient by a factor of two or more except at low concentrations of the diffusing component where the agreement was within 5 to 10%. A general relationship between the mutual and self-diffusion coefficients recently proposed by Lamm and based on the existence of two frictional forces in the system was shown to be approximately true for the ideal system. The behaviour of the non-ideal systems may be rationalized with this theory of the forces are considered to vary with solution composition. A.

532.72

7194. DIFFUSION IN IDEAL BINARY LIQUID MIXTURES. L.S.Caldwell and A.L.Babb.
J. phys. Chem., Vol. 60, No. 1, 51-6 (Jan., 1956).

Mutual diffusion coefficients of several binary liquid systems that behave nearly ideally have been measured with a Mach—Zehnder interferometer and a single-channel diffusion cell over a temperature range of 15 to 40°. The diffusion coefficients for these systems vary almost linearly with mole fraction over the entire concentration range. A linear relation between $D\eta/T$ and mole fraction was obtained, so that diffusion coefficients of any non-associated solutions at any composition may be predicted from those at infinite dilution as proposed by Roseveare, Powell and Eyring. In addition, the applicability of the rate-process theory of Eyring to the prediction of diffusion coefficients for these solutions at infinite dilution is discussed. A.

532.73

7195. CELL MODEL FOR SOLUTIONS AND THE ADDITIVITY OF FREE ENERGIES. S.A.Rice.
J. chem. Phys., Vol. 24, No. 6, 1283 (June, 1956).

Previous models have only considered particles executing independent motions. The theory is extended to include cooperative motions of pairs, triplets, ... of molecules. When the pure components are in a state where their reduced temperatures and volumes correspond to the reduced temperatures and volumes characteristic of their environment in solution, the free energy of the mixture equals the sum of the free energies of the components. G.Allen

532.73

7196. CORRESPONDING STATES TREATMENT OF NON-ELECTROLYTE SOLUTIONS. R.L.Scott.
J. chem. Phys., Vol. 25, No. 2, 193-205 (Aug., 1956).

Recent theories of solutions (Prigogine and co-workers; Salsburg and Kirkwood) use a theory of corresponding states to deduce the properties of solutions from theoretically derived properties of the pure components (e.g. from the Lennard-Jones and Devonshire "free volume" or "cell" model). A characteristic of these theories is that they predict for molecules of the same size and dispersion force interactions a negative volume change on mixing. Since the "cell" model gives very poor agreement with experimental data on energy—volume and volume—temperature relations of pure liquids, a corresponding states treatment has been carried through using an experimental equation of state for the pure liquid. If one assumes two kinds of "cells" in the mixture, a type for each of the components, the results agree with experimental data on solutions at least as well as previous theories. As before, contraction on mixing is found for a certain class of dispersion force solutions. In any corresponding states treatment, the entropy of mixing will not be ideal either at constant pressure or at constant volume. A.

532.73 : 539.152.2

7197. PROTON RELAXATION IN SOLUTIONS OF CHROMIUM (III) COMPLEXES. L.O.Morgan, A.W.Nolle, R.L.Hull and J.Murphy.
J. chem. Phys., Vol. 25, No. 2, 206-8 (Aug., 1956).

Spin-lattice relaxation times were observed for protons in a number of aqueous solutions of symmetrical chromium (III) complexes. The observed times were in the order to be expected if it is assumed that those ions displaying the greatest tendency to interact with solvent water also exhibit the greatest relaxation effect. Thus, relaxation times for protons in solutions of the ions $Cr(H_2O)_6^{+3}$, CrF_6^{-3}, $Cr(NH_3)_6^{+3}$, $Cr(C_2O_4)^{-3}$, $Cr(en)_3^{-3}$ and $Cr(CN)_3^{-3}$ were observed to increase in the order given. A.

532.73

7198. ENERGY TRANSFER FROM SOLVENT TO SOLUTE IN LIQUID ORGANIC SOLUTIONS UNDER ULTRA-VIOLET EXCITATION. S.G.Cohen and A.Weinreb.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 593-605 (June, 1956).

The transfer of molecular excitation energy from solvent to solute in liquid organic solutions under ultra-violet excitation has been studied as a function of different parameters such as solute concentration, exciting wavelength and dilution of absorbing solvent with a second transparent solvent. By measuring the fluorescent efficiencies of the solutions at different exciting wavelengths the intrinsic transfer efficiency can be found. It is found that the transfer probability is accurately proportional to the solute concentration, and is independent of exciting wavelength in the region in which the solvent absorbs appreciably. An investigation of the quenching of the transfer process by carbon tetrachloride shows that an average time of about 10^{-9} second must elapse before the solvent excitation energy is transferred to the solute at optimum solute concentrations. It is shown that in diluted systems the solvent excitation energy is not exchanged between different solvent molecules before transfer. In undiluted systems there is evidence for a short range interaction between the solvent molecules leading to a relatively weak transfer of excitation energy through neighbouring solvent molecules. It is shown that the processes of natural solvent fluorescence and solvent-solute transfer are not competing processes which can take place from the same molecular state. A.

532.74

7199. COMPARISON OF INFRARED AND CRYOSCOPIC STUDIES OF SOLUTIONS OF PYRROLE IN NONPOLAR SOLVENTS. FORMATION OF POLYMERS. M.L.Josien, P.Pineau, M.Paty and N.Fuson.
J. chem. Phys., Vol. 24, No. 6, 1261-2 (June, 1956).

The cryoscopic behaviour of pyrrole in cyclohexane solutions indicates that the association results in polymers and a value for the equibrium constant (Kp) has been obtained. A constant value for Kp has also been computed from infrared intensity measurements of pyrrole N—H bands, in CCl_4 solutions. NH....N hydrogen bonds offer a satisfactory explanation of the complexes. G.Allen

532.74 : 541.133

7200. CONDUCTIVITY OF STRONG ELECTROLYTES AT MODERATE CONCENTRATIONS. R.M.Fuoss.
J. Chim. phys., Vol. 53, No. 6, 493-500 (June, 1956). In French.

Following a discussion of the insufficiency of the equations of Debye and Hückel and of Onsager, a new equation is proposed $\Lambda = \Lambda_0 - \alpha\Lambda_0\sqrt{c}(1 - \Delta_1 + \Delta_2) - \beta(1 + \Delta_3)\sqrt{c}$ (where Δs are defined functions and c is the concentration), which gives better results than the above for the conductivity of strong electrolytes at moderate concentrations. The equation is applicable to the cases of ion association and permits the determination of association constants. H.H.Hodgson

532.77

7201. ADDITIVITY OF THE PARACHORS OF SOLUTIONS. M.Puchalik.
Acta phys. Polon., Vol. 14, No. 5, 379-84 (1955). In German.

The variation of the parachor of solutions with their concentration has been investigated. The additivity law holds in only a few of the cases examined. The solutions investigated fall into three classes: (1) those where the parachor of the solution P_{12} is given by $P_{12} = P_1(1 - f_2) + P_2 f_2^k$, where P_1, P_2 are the parachors of the solvent and the solute, f_2 is the mol fraction of the solvent, and k is a constant. Solutions of Et_2O in C_6H_6 and of $C_6H_5NO_2$ in C_6H_6 fall into this class. (2) Solutions in which P_{12} first decreases with increasing concentration, although the parachor of the solute is considerably greater than that of the solvent. At a certain concentration P_{12} then increases linearly with increasing f_2 up to $f_2 = 1$. The linear part of the curve is expressed by $P_{12} = k_0 P_1(1 - f_2) + P_2 f_2$. Solutions of EtOH in H_2O and β-naphthol in EtOH fall into this class. (3) Solutions for which the parachors are additive functions of concentration. Solutions

of EtOH in benzene, and of α-naphthol and β-naphthol in Et_2O fall into this class. A.J.Mee

MECHANICS OF GASES 533

533.5 : 531.788.7

7202. ELECTRICAL CLEANUP OF GASES IN AN IONIZATION GAUGE. J.R.Young.
J. appl. Phys., Vol. 27, No. 8, 926-8 (Aug., 1956).

Observations have been made on the electrical cleanup of different gases in a Bayard–Alpert ionization gauge. It has been found that the ion current striking the wall of such a gauge is 5 to 10 times that reaching the ion collector. It is therefore possible to account for a maximum pumping speed of 0.1 to 0.2 l/sec due to ion pumping at the gauge walls. The maximum pumping speed observed was 0.1 l/sec for nitrogen. It was found that the maximum pumping speed for nitrogen remained the same when the inner wall of the ion gauge was covered with a thin metal deposit or Aquadag. An expression has been derived on the basis of ion pumping which describes the observed cleanup. A.

533.6.011

7203. EXPERIMENTAL INVESTIGATION ON THE TRANSITION OF LAMINAR SEPARATED LAYER. H.Sato.
J. Phys. Soc. Japan, Vol. 11, No. 6, 702-9 (June, 1956).

A transition from the laminar to the turbulent air flow for a layer separated from a surface was investigated in detail. The laminar flow mean velocity distribution in the separated layer is similar to that in the laminar boundary layer and it agrees with Lin's calculation. In the transition region, a hot-wire anemometer survey of velocity fluctuation revealed the existence of a sinusoidal wave, the frequency of which lies in the unstable zone predicted by the stability theory. Transition regions determined by the layer thickness and by the fluctuation measurements are in good agreement. A simple empirical relation was derived for the transition distance. A.

533.6.011.5

7204. ANALYTICAL TREATMENT OF TWO-DIMENSIONAL SUPERSONIC FLOW. I. SHOCK-FREE FLOW. J.J.Mahony and R.E.Meyer.
Phil. Trans. A, Vol. 248, No. 952, 467-98 (1956).

A solution is presented for the general, wave-interaction problem of steady, irrotational, homentropic flow of a perfect gas. It can be interpreted as a convergent process of successive approximations, based on the solution of linearized theory, for shock-free flow. It constitutes an approximate solution for flow with weak shocks. The equations of motion are transformed into linear equations in characteristic variables. Their solution is of different type according to whether the flow is near-sonic, hyper-sonic, or in between these extremes. Special attention is given to the types of boundary condition which occur in physical problems, and solution methods are devised to cope with these types in the medium Mach number range. The method of Riemann functions is used to calculate accurately the pressure distribution in the first interaction region of a jet expanding from a perfect nozzle. It is shown by the help of double power series that shock waves will always occur in the first "period" of such a jet, even for pressure ratios arbitrarily near unity. The Riemann function approach is also shown to be suitable for the approximent calculation of the flow past aerofoils of prescribed shape; when the requirements of accuracy are exacting, the method of double power series expansion presents the problem in a form suited to high-speed digital computers. A.

533.6.011.

7205. ANALYTICAL TREATMENT OF TWO-DIMENSIONA SUPERSONIC FLOW. II. FLOW WITH WEAK SHOCKS. J.J.Mahony.
Phil. Trans. A, Vol. 248, No. 952, 499-515 (1956).

A scheme of approximate solution is presented for the treatment of shock waves in the steady, plane flow of a perfec gas. It is based on the neglect of any entropy variations produced by the shocks and hence is applicable only when the shocks are weak. The method provides an extension of Friedrichs's (1948) results for simple waves to wave-interact ion regions. By an examination of the solution of the continuous-flow equations in the neighbourhood of a known shock wav it is shown how the downstream flow may be calculated withou reference to the particular shock shape. There are certain cases in which this approach fails and they are discussed by means of a typical example. Once the downstream flow has been calculated, it is possible to set up general equations for the determination of the shock. Examples of the solution of these equations for typical problems are given. There is a brief discussion of the validity of using homentropic theory and estimates of the errors involved in the solution process are obtained. A

533.6.3

7206. VISUALIZATION OF AERODYNAMIC PATTERNS OF FLOW PAST AXISYMMETRIC BODIES WITH THE AID OF A PLANE LAYER OF COLOURED GAS. A.A.Yuzefovich, T.N.Mirshanov and Yu.A.Dunaev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 73-4 (1956). In Russian.

A brief note. Density changes in the plane of symmetry of a body of rotation in compressible flow can be observed an if required, quantitatively estimated by projecting the body along a plane layer of coloured gas (e.g. a 2-3 mm thick layer of bromine vapour in one of the Freons). A.Gelbtuch

MOLECULAR THEORY OF GASES 533.7

533.7 : 539.13

7207. CONCEPT OF INTERMOLECULAR FORCES IN COLLISIONS. J.F.Hornig and J.O.Hirschfelder.
Phys. Rev., Vol. 103, No. 4, 908-17 (Aug. 15, 1956).

For polar or electronically excited molecules the concept of intermolecular forces requires clarification. To calculate the equation of state or equilibrium properties, it suffices to use intermolecular forces which are averaged over the magnetic quantum numbers, but for nonequilibrium or transport properties it is necessary to know the intermolecular energy for each separate quantum state. There are many different representations of intermolecular forces, depending on which degrees of freedom are treated quantum mechanically and which classically. The whole concept of intermolecular force becomes nebulous when a large fraction of the collisions are not adiabatic. A semiclassical treatment is developed for des cribing the trajectories of nonadiabatic collisions in which transitions occur infrequently. For grazing collisions, the colliding molecules are loosely coupled and best represented in terms of space-fixed coordinates, but when the molecules approach each other more closely the internal degrees of free dom become tightly coupled, and then the intermolecular forces are best calculated in terms of a body-fixed representation. The collisions with tight coupling are especially important for determining the kinetic theory properties of gases. A

533.7 : 530.162

THE RELATIVISTIC MAXWELL–BOLTZMANN COLLISION EQUATION. See Abstr. 6398

VIBRATIONS. ACOUSTICS 534

534

208. THE GENERALIZED RADIALLY SYMMETRIC WAVE QUATION. A.G.Mackie.
roc. Roy. Soc. A, Vol. 236, No. 1205, 265-77 (Aug. 2, 1956).

A detailed study is made of solutions of the differential quation

$$\frac{\partial^2\phi}{\partial R^2} + \frac{k}{R}\frac{\partial\phi}{\partial R} - \frac{\partial^2\phi}{\partial T^2} = 0$$

the quarter plane $R \geq 0$, $T \geq 0$. The boundary value problem considered is that of finding a solution which satisfies auchy data on $T = 0$. The contour integral solutions developed or an equation occurring in gas dynamics, shown to be equivalent to that considered here, are the main aid in the investigation. The solution is obtained first for values of $T \leq R$ but continued into the whole quarter plane. This continuation ollows from a fundamental uniqueness result that knowledge f ϕ on the characteristic $R = T$ specifies its value in the omain $R \leq T$. A point emphasized is that the continuation is ot in general the analytic continuation from the domain $T \leq R$, ven for analytic initial data. Different interpretations of the olutions found are examined. When k is a positive integer the quation is that satisfied by radially symmetric solutions of the ave equation in k + 1 space dimensions, and this leads to the olution of the full wave equation for given initial conditions on = 0. The Huygens principle is clearly illustrated. For eneral positive values of k the discussion clarifies a problem n gas dynamics in the study of which the original contour integral solutions were first devised. The general solution is also ompared with a solution by separation of variables, and some onclusions are drawn regarding certain infinite integrals nvolving Bessel functions. In the final section negative values f k are considered. The contour integral representation olves in a concise form the singular initial value problem of inding a solution which takes prescribed values on $R = 0$, thus eneralizing a result well known for positive values of k. A.

534.14 : 534.321.9

7209. THE EXCITATION OF ULTRASONIC VIBRATIONS BY PONDEROMOTIVE FORCES. S.I.Aksenov, B.P.Vikin and K.V.Vladimirskiĭ.
Zh. éksper. teor. Fiz., Vol. 28, No. 6, 762-4 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 1, No. 3, 609-11 (Nov., 1955).

Resonances were observed at various megacycle frequencies in a nuclear magnetic resonance apparatus. These were found to be due to mechanical vibrations in the conductor wires of the spectrometer coil, the various frequencies corresponding to those calculated for a circular plate, of the diameter of the conductor, vibrating in its own plane; the lower modes were most strongly excited. From the width of the resonances, the proportion of the total power dissipated by this process was determined to be 10^{-3}, in agreement with calculation. It is of interest that a resonance in a Pb conductor at 12.5 Mc/s was quite narrow, indicating low damping at this frequency.

W.Bardsley

534.2

7210. THE GENERATION OF WAVES IN AN INFINITE ELASTIC SOLID BY VARIABLE BODY FORCES. G.Eason, J.Fulton and I.N.Sneddon.
Phil. Trans. A, Vol. 248, No. 955, 575-607 (1956).

This is concerned with the determination of stress in an infinite elastic solid when time-dependent body forces act upon certain regions of the solid. It is assumed throughout that the strains are small. A general solution of the equations of motion for any distribution of body forces is derived by the use of four-dimensional Fourier transforms, and from that is derived the general solution for an isotropic solid. From the latter solution are deduced the general solution of the statical problem and the two-dimensional problem. The solution of the equations of motion in the case in which the distribution of body forces is symmetrical about an axis is also derived. The remainder of the paper consists in deducing the solution of special problems from these general solutions. Some typical two-dimensional problems are considered and exact analytical expressions found for the components of the stress tensor. Examples are given of the use of the general non-symmetrical three-dimensional solution, and examples are given to illustrate the use of the general solution of the axially symmetrical problem. A certain amount of numerical work (presented in graphical form) is quoted to give some idea of the physical nature of the solutions. A.

534.2

7211. ON THE PROPAGATION OF ELASTIC WAVES IN AEOLOTROPIC MEDIA. III. MEDIA OF CUBIC SYMMETRY. G.F.Miller and M.J.P.Musgrave.
Proc. Roy. Soc. A, Vol. 236, No. 1206, 352-83 (Aug. 2, 1956).

The general analysis presented in Pt I (Abstr. 800/1955) is adapted to obtain the velocity, inverse and wave surfaces of a medium of cubic symmetry. Using the elastic constants of (a) aluminium and (b) nickel, the co-ordinates of points on the velocity and inverse surfaces which lie in (1, 0, 0) and (1, 1, 0) planes have been calculated and plotted. The corresponding points on the wave surface, which also lie in these planes of symmetry, have been derived, but the sections of the wave surface so obtained are incomplete. The results of an extensive computation of points on the wave surface for copper are presented and from these and the reciprocal relation between inverse and wave surfaces the nature of the wave surface is inferred. The geometrical singularities of the surface so envisaged are given physical interpretations. A.

534.22

7212. ANOMALOUS SOUND DISPERSION IN THE FATTY ACIDS. W.G.Mayer and E.A.Hiedemann.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 649-51 (July, 1956).

An ultrasonic pulse method is used to measure the velocity dispersion due to changes in sound intensity in three fatty acids. With constant frequency the velocity increases with increasing amplitude in the ranges from the melting points to approximately 15° C above. A.

534.22 : 536.44

7213. POSSIBLE INFLUENCE OF STRUCTURAL RELAXATION PROCESSES ON THE VELOCITY OF PROPAGATION OF SOUND AT THE CRITICAL POINT. L.Galatry and J.Noury.
J. Phys. Radium, Vol. 17, No. 4, 375-6 (April, 1956). In French.

The velocity of sound measured as a function of pressure passes through a very sharp minimum in the critical region. This phenomenon is qualitatively explained by the fact that in this region the isothermal compressibility of fluids passes through a maximum. Divergence in recent observations of this effect show that it cannot simply be explained on the basis of the equations of state. It is now suggested by the authors that there exists a "liaison" between the particular properties of "structural relaxation" attributed to the critical state, and the possibility of an abnormal behaviour of the velocity and of the absorption of sound in this region. A.B.Wood

534.222.2

7214. ON THE STABILITY OF THE GUDERLEY SPHERICAL COMPRESSION SHOCK WAVES. W.Häfele.
Z. Naturforsch., Vol. 11a, No. 3, 183-6 (1956). In German.

534.23/.24

7215. WAVE TRANSMISSION AROUND BENDS OF DIFFERENT ANGLES IN RECTANGULAR DUCTS. W.K.R.Lippert.
Acustica, Vol. 5, No. 5, 274-8 (1955).

The characteristic reflection and transmission factors of bends of various angles in rectangular tubes have been measured for plane waves by using the technique of the non-reflect-

ing output duct. The frequency characteristics for angles greater than 90° give complex curves which show a systematic change with increasing angle. Altering the shape of a bend has a great effect on the values of the characteristic factors; this is shown experimentally with a rounded right-angled bend. The propagation of plane waves around the various bends is completely specified by the measured magnitude and phase values of the characteristic factors. These provide a set of basic characteristics for designing acoustical filters. A.

534.23

7216. THE TRANSMISSION OF A PLANE WAVE BETWEEN PARALLEL PLATES. I.D.Campbell.
Acustica, Vol. 5, No. 6, 298-302 (1955).

The transmission of a plane wave between infinite parallel plates is discussed theoretically, allowance being made for the effects of viscosity and thermal conduction. The use of an approximate method allows the attenuation and phase velocity to be deduced at all frequencies. Some experimental measurements are presented for comparison with the theory. A.

534.23

7217. TRANSMISSION OF ULTRASONICS THROUGH BINARY LIQUID MIXTURES. M.Krishnamurthi.
Proc. Indian Acad. Sci. A, Vol. 43, No. 2, 106-12 (Feb., 1956).

Ultrasonic velocities and absorption in five binary liquid mixtures have been studied in relation to their concentration. They are benzene–ethylene dichloride, ethyl alcohol–oleic acid, dioxane–ethyl methyl ketone, benzyl alcohol–ethyl alcohol and benzyl alcohol–isopropyl alcohol. The rapid increase in absorption of benzene with the addition of small quantities of ethylene dichloride, the negligible influence of small quantities of ethyl alcohol on the high absorption of oleic acid, the sharp peak in absorption–concnetration curve in the case of ethyl methyl ketone–dioxane mixtures, the sharp minima in the last two mixtures are explained qualitatively. A.

534.23

7218. ULTRASOUND ABSORPTION IN WATER AND ITS DEPENDENCE ON THE TEMPERATURE AND AIR CONTENT OF THE WATER. S.K.Mukhopadhyay.
Acustica, Vol. 6, No. 1, 25-34 (1956). In German.

The ultrasonic absorption in water and its dependence on temperature (20° to 28° C) and dissolved air-content (1 to 102% saturation) were investigated at a frequency of 48 Mc/s using the optical method of Debye and Sears. It appears that within the precision of experiment (± 4%) the air-content had no effect on the ultrasonic absorption, the carbon dioxide content not being reckoned. The coefficient of variation of absorption α with temperature was negative, as generally found, αf^{-2} having a value 25.3×10^{-15} s^2.m^{-1} (f=frequency) at 20°C. A.

534.23 : 532.7

7219. A REVERBERATION METHOD FOR THE MEASUREMENT OF THE ABSORPTION OF ULTRASONICS IN LIQUIDS. L.E.Lawley and R.D.C.Reed.
Acustica, Vol. 5, No. 6, 316-22 (1955):

The ultrasonic reverberation of a liquid contained in a spherical vessel of about 0.5 litres volume has been investigated experimentally over the frequency range 200 kc/s to 2 Mc/s. The time constant of acoustic exponential decay was measured by a null method in which it was balanced against an exponential waveform of known time constant generated in an RC network. The mechanism of energy loss in the vessel was investigated and this loss was allowed for by calibration of the vessel using a liquid of known absorption. The absorption was determined in a number of organic liquids and evidence of relaxation effects was observed in methyl benzoate, toluene and acetaldehyde. A.

534.23

7220. ULTRASONIC ABSORPTION IN METALS AT ELEVATED TEMPERATURES. C.Zucker.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 721-3 (July, 1956).

The use of the ultrasonic pulse technique as a means of measuring ultrasonic absorption in an aluminium alloy (2S) at high temperatures has been considered. The absorption for both the longitudinal and shear waves was computed. These measurements show that the absorption is relatively constant up to approximately 200° C where it then experiences a large increase. The major part of the absorption at high temperatures is found to be due to thermal effects. A

534.23

7221. ULTRASONIC ABSORPTION IN ALKYL IODIDES. V.Narasimhan.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 723 (July, 1956).

Measurements of the absorption coefficients of some alkyl iodides at several temperatures are described. The values differ markedly from those reported by some earlier workers A

534.23 : 532.7

7222. ULTRASONIC RELAXATION AND THE VIBRATIONA SPECIFIC HEAT OF CARBON DISULPHIDE. J.H.Andreae, E.L.Heasell and J.Lamb.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 625-32 (June, 1956).

Previous work has shown that the absorption of ultrasonic waves in liquid carbon disulphide is governed by a relaxation mechanism. The measurements reported from this work were made below the frequency of 70 Mc/s, which is near the centre of the dispersion range at 25° C. Combining these results with others reported by Rapuano in the frequency range of 75 Mc/s to 195 Mc/s, led to the conclusion that the observed behaviour was associated with the time of transfer of energy to the degenerate bending vibration of the carbon disulphide molecule. Quantitative analysis of the results, however, was not regarded as satisfactory. Measurements of the absorption of ultrasonic waves in carbon disulphide have now been made by the authors at frequencies up to 190 Mc/s and at different temperatures. The results obtained do not agree with Rapuano's particularly at the higher frequencies so that his measurements have been discarded. Analysis of the complete experimental results now available at both 25° C and −63° C shows conclusively that the anomalous absorption in carbon disulphide is due to the relaxation of the total vibrational specific heat as described by a single relaxation time. Moreover, the absorption at frequencies well above the relaxation region appears to be determined by the "classical" mechanisms of shear viscosity and thermal conduction. A

534.231.3

7223. THEORY OF AIR-BORNE SOUND TRANSMISSION LOSS IN CYLINDRICAL SHELLS. L.Cremer.
Acustica, Vol. 5, No. 5, 245-56 (1955). In German.

The transmission-impedance of a cylindrical shell is given by the mass-reactance, together with the reactance of stiffness against bending and by a third reactance due to the tension of the shell which is involved in deformation. This stiffness-reactance against tension depends on the incidence of the waves and is for a given direction inversely proportional to frequency. If the trace-velocity equals the velocity of longitudinal or of shearing waves, the tensional stiffness becomes infinite and therefore the transmission loss too. This happens near perpendicular incidence only. Excluding this region the tensional stiffness is proportional to $\sin^4\beta$, where β means the angle between the plane of incidence and the plane perpendicular to the axis. For high frequencies the mass-reactance and the stiffness-reactance against bending may compensate each other as in the case of plane waves (coincidence effect). Here a similar compensation of the mass-reactance and stiffness-reactance against tension is possible at frequencies below the zero-mode frequency of the shell. Averaging over all directions of incidence one obtains a flat frequency response of the transmission loss. For shells with small diameter compared to the wave-length mainly axial motions are to be expected

ithin the shell. Then the stiffness against tension will pre-
nderate and the transmission loss will increase towards low
equencies. A.

534.232

224. THE NATURAL FREQUENCIES OF HORNS. T.Lange.
custica, Vol. 5, No. 6, 323-30 (1955). In German.

The impedances at the throat and natural frequencies are
lculated for horns which consist of a pressure chamber, a
nnecting tube of constant cross-section and a terminating
lmon horn (widening in the hyperbolic or catenoidal form).
spite of uncertain end-corrections the calculations agree
ith more precise measurements. The resonances are inhar-
onic, because of the pressure chamber as well as of the
idening of the horn. In special cases it is possible to offset
e two influences so as to produce natural frequencies in har-
ionic relationship. A.

534.232

225. VARIABLE RESONANT TRANSDUCER. D.H.Robey.
Acoust. Soc. Amer., Vol. 28, No. 4, 700-4 (July, 1956).

The application of lateral forces by a relatively stiff struc-
ure such as a small iron vice to one end of a longitudinally
ibrating crystal or composite bar, e.g. a crystal and backing
late, has been used to control and vary the resonant frequency
f the system. A change in resonant frequency of over an
ctave for a composite system has been measured. It is be-
ieved that the phenomenon depends upon the (dynamic) elastic
ange of friction as first noted for the static case by
.S. Stevens in 1899, in addition to the elastic parameters. It
s noted that for a given crystal (material and dimensions) and
acking plate (material) there are optimum backing plate
engths to obtain both maximum and minimum changes in reson-
nt frequency. For example a one inch 45° Y-cut Rochelle salt
rystal with a one-half inch steel backing plate can undergo a
ontinuous change in resonant frequency from 26.5 to 66.7 kc/s.
he same crystal with a three inch backing plate will only
hange from 22.2 to 24.4 kc/s. It was found that the type of
lamping herein described results in an additional mode of vi-
ration which may be very low in frequency depending on the
ateral force. A.

534.232 : 534.64

226. TRANSDUCER CALIBRATION BY IMPEDANCE
MEASUREMENTS. G.A.Sabin.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 705-10 (July, 1956).

A self-reciprocity free-field response calibration of a
esonant electroacoustic transducer may be determined in a
mall water-filled tank by only two electrical impedance
neasurements at each discrete frequency point. The use of a
ulse technique permits the measurement of electric imped-
nce under two conditions: (1) in a free field and (2) under
he influence of a totally reflected signal. The vector differ-
nce between these two impedances together with the reciproc-
ty parameter (J) establish the free-field response. No meas-
rement of voltage, current, or power is required; the ratio
f the hydrophone voltage to the projector current is measured
s an impedance vector. This method is particularly applicable
n the ultrasonic frequency range. A.

534.321.7

7227. ON MEMORIZING ABSOLUTE PITCH. M.F.Meyer.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 718-19 (July, 1956).

The author, in defence of the psychologists' theory of
bsolute pitch, lists several instances of false premises in
Bachem's arguments (Abstr. 1006/1956). J.B.Arthur

534.321.9 : 621.317.38

7228. POWER MEASUREMENTS IN ULTRASONICS.
O.E.Mattiat.
I.R.E. Trans Ultrasonics Engng, No. PGUE-3, 23-31 (May,
1955).

Ultrasonic power can be determined from measurements
of either p, the sound pressure, v, the particle velocity or
P_r, the radiation pressure, quantities whose relationships to
the associated power and to one another are explained. These
quantities can be measured by either (1) electrical or (2) mech-
anical means. As regards (1), p can be measured by means of
electro-acoustic transducers, such as condenser microphones
or piezo-electric crystals, while v can be determined from the
voltage set up in electro-kinetic probes consisting of silk- or
cotton-covered wires immersed in a weak electrolyte. Several
types of sound probes, making use of the cooling and heating
effects of ultrasonic fields, can be employed. With regard to
(2), Rayleigh disks can be used to measure p, while much
larger disks, taking various forms, are suitable for measur-
ing P_r. This quantity can also be established from the height
of the ultrasonic fountain, a special design of which, using a
focusing transducer, is described in detail. H.G.M.Spratt

534.61

7229. ACOUSTIC WATTMETER. T.J.Schultz.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 693-9 (July, 1956).

The author has constructed a device which gives pointer
indications of acoustic intensity over a 50 dB range at fre-
quencies up to 10 000 c/s. The signals from a pair of pres-
sure-sensitive condenser microphones, mounted back-to-back
in a space roughly the size of a dime, are treated electronic-
ally to provide pressure and velocity signals which are then
multiplied and averaged in a specially designed moving-coil
dynamometer to give precise pointer readings. The theory of
operation of the apparatus is discussed and the paper concludes
with a brief account of the test results of the acoustic watt-
meter. A.

534.61

7230. HYDROPHONE FOR MEASURING PARTICLE VELO-
CITY. C.B.Leslie, J.M.Kendall and J.L.Jones.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 711-15 (July, 1956).

Mathematical expressions are derived for the motion of a
rigid, uniform sphere in an underwater sound field. The re-
sults show that at low frequencies a neutrally buoyant sphere
of this type has a velocity equal to the particle velocity of the
water at the same location when the sphere is removed. A
velocity pickup may be mounted inside such a sphere to form
a hydrophone sensitive to particle velocity. Two practical de-
sign applications are presented. A low-frequency hydrophone
with a diameter of five inches was constructed having an essen-
tially flat response between 15 and 700 c/s with a sensitivity of
0.18 volt/cm/sec working into a 500 ohm load. A higher fre-
quency design with a 2.5 inch diameter operated from 70 to
7000 c/s with somewhat lower sensitivity and impedance level.
Velocity hydrophones of this type are easy to build, easily
calibrated, stable, and possess good directionality. A.

534.62

7231. SENSITIVE ELECTRODYNAMIC BALANCE FOR
MEASUREMENT OF ABSORPTION OF ULTRASONIC WAVES
IN LIQUIDS. M.Mokhtar and H.Youssef.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 651-5 (July, 1956).

A new method for measurement of absorption of ultrasonic
waves in liquids is developed. Its main feature is a low fre-
quency modulated ultrasonic transducer actuating a thin circu-
lar disk which is placed at some distance above it within the
ultrasonic cell. The disk is suspended by a glass rod from a
metallic reed which forms one plate of a small air condenser.
The vibrations of the suspended system, which are resonant
with the l.f. modulating component, are detected by a crystal
controlled oscillator, working at the steep portion of its cre-
vasse. The output of the oscillator is applied to a wave analys-
er whose output gives directly a measure of the ultrasonic
pressure on the disk. In a further development in the detecting
end, a null method is used in which the reed is brought to rest
by a l.f. balancing voltage supplied by the same modulator and
the zero reading is adjusted by the aid of a cathode-ray oscil-
lograph. Two liquids are chosen for testing the apparatus,
namely, benzene and water representing both high and low

absorptive liquids, respectively. The values obtained are, $2\alpha/\nu^2 = 16.2 \times 10^{-15}$ sec^2.cm^{-1} for benzene, and $2\alpha/\nu^2 = 52 \times 10^{-17}$ sec^2.cm^{-1} for water, which compare favourably with the values obtained by the more elaborate pulse method. Moreover, the high sensitivity of the method eliminates all the complications which usually accompany high-power ultrasonic beams. A.

534.64 : 537.311.6 : 621.317.332.1

7232. AN IMPEDANCE MEASURING SET FOR ELECTRICAL, ACOUSTICAL AND MECHANICAL IMPEDANCES. E.W.Ayers, E.Aspinall and J.Y.Morton.
Acustica, Vol. 6, No. 1, 11-16 (1956).

An impedance to be measured is compared with a reference impedance of similar nature by connecting each in turn to a source of adjustable strength. If the internal impedance of the source is constant, the vector ratio of the unknown and reference is the ratio of the changes in stimulus required to restore the source to short-circuit conditions, or the reciprocal of this ratio if the source is restored to open-circuit conditions. A.

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85.

534.77 : 534.831

7233. COMMENTS ON "THE RELATIONS OF HEARING LOSS TO NOISE EXPOSURE", D.R. CRITERIA, ETC. W.A.Rosenblith and K.N.Stevens.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 716-17 (July, 1956).

The discussion arises from a publication "The relations of hearing loss to noise exposure" — a report by an exploratory subcommittee Z 24 - X 2 of the American Standards Assoc. Inc. New York 1-64, 1954. D.R. stands for damage risk and not for deafness risk. Further reference is made in particular to a paper by Webster and Solomon (Abstr. 6851/1955) which contains valuable data on hearing loss for aircraft shop personnel and for submariners. The present note discusses the implications of this paper in the subject of D.R. criteria. In the assessment of hearing loss a biological baseline or reference level was used. A.B.Wood

534.77 : 534.831

7234. REPLY TO COMMENTS ON "THE RELATIONS OF HEARING LOSS TO NOISE EXPOSURE". J.C.Webster and L.N.Solomon.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 717-18 (July, 1956).

Deals with some of the points raised by Rosenblith and Stevens (preceding abstract). A.B.Wood

534.78

7235. A TONAL METHOD OF DETERMINING INTELLIGIBILITY OF SPEECH TRANSMITTED BY PATHS OF COMMUNICATION. A.D.Tkachenko.
Akust. Zh., Vol. 1, No. 2, 171-80 (1955). In Russian.

The paper appears to have been prompted by recent work on the quality of speech transmitted by telephone systems. A new method is proposed for determining the intelligibility of speech transmitted by a path without carrying out articulation tests. The theoretical basis is given and the essential data to enable it to be used practically. C.R.S.Manders

534.78

7236. EFFECT OF ATTENUATING ONE CHANNEL OF A DICHOTIC CIRCUIT UPON THE WORD RECEPTION OF DUAL MESSAGES. G.C.Tolhurst and R.W.Peters.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 602-5 (July, 1956).

Listeners responded to two simultaneous messages through dichotic headset circuits. Each message consisted of word groupings from the multiple-choice intelligibility tests. The signal level of one of the messages remained constant while the level of the contralateral message was attenuated in five steps of three decibels each step. The variable under study was the effect of these attenuation levels upon the reception of the two messages. The simultaneous messages were received under conditions of noise and quiet. The findings we that the general effect of attenuating one of the simultaneous messages was that of decreasing the reception scores of the attenuated message and increasing the reception of the unatte uated message. The effect was more pronounced in noise tha in quiet. A

534.78

7237. DETECTION OF SIGNALS IN NOISE: A COMPARISO BETWEEN THE HUMAN DETECTOR AND AN ELECTRONIC DETECTOR. C.W.Sherwin, F.Kodman, Jr, J.J.Kovaly, W.C.Prothe and J.Melrose.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 617-22 (July, 1956).

The observer's responses to aural signals in noise are compared to the output of an electronic detection system whos constants are intended to be close to those of the human audit detection system. Of the four variations of an electronic detector tested, the best correlation between the detector and the observer occurred for signals of duration 0.3 second, banc pass 60 c/s (single tuned RLC circuit), square law detector, output filter time constant, 0.15 second. The incomplete corr lation between the signal responses of the observer and the detector can be explained by assuming that the observer's threshold fluctuates randomly about a mean value with a dispersion of about 20% of the mean, or alternatively that there i internal noise with this dispersion generated inside the obser er's detection system. The observer's false alarms appear to be caused by noise fluctuations (as measured by the electronic detector) of the same average magnitude and dispersion as those calculated for a detector with the same threshold fluctua tion. However, the observer's false alarm rate is about an order of magnitude lower than that calculated for the fluctuati threshold detector so it is clear that the model is deficient in some important respects. A.

534.79

7238. THE SIGNIFICANCE OF THE FREQUENCY GROUP FOR THE LOUDNESS OF SOUNDS. H.Bauch.
Acustica, Vol. 6, No. 1, 40-5 (1956). In German.

The "breadth of a frequency group", well-known in other researches on hearing, intervenes as a practical limit also in the investigation of the laws by which the ear estimates the loudness of a complex sound. If the whole spectrum falls in the same frequency group, the ear judges the loudness from the total intensity presented. The ear can follow fluctuations in intensity at a slower rate than about 3 c/s. The peaks in such fluctuations determine the loudness level. If the frequenc band is wider than a single frequency group the loudness is given by adding the loudness in the several groups. A

534.793

7239. EARPHONE, PROBE TUBE MICROPHONY AND AUDIOMETRIC ZERO. J.D.Harris.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 726-7 (July, 1956).

Reporting audiometric threshold in terms of SPL (sound pressure level) at the entrance to the ear canal makes the assumption that equal SPL yields equal loudness regardless of the type earphone used. This is shown not to be always the case. Loudness balances between the W.E. 552 and the W.E. 705 A phone yield data composing differences among three laboratories as to what SPL at the entrance to the ear canal constitutes American "audiometric zero". Loudness balances and threshold measurements using the W.E. 705 A and a British earphone. Standard Telephones and Cables Ltd., Type 4026 A, show the British phone generating more SPL at the entrance to the ear canal for equal loudness. This difference must be added as a correction factor to ear canal SPL using the 705 A earphone if one wishes to compare American threshold surveys with British surveys by probe tube microphony. A

534.833.1

7240. A METHOD OF MEASURING FLANKING TRANSMISSION IN FLATS. J.van den Eijk and M.L.Kasteleyn.
Acustica, Vol. 5, No. 5, 263-6 (1955).

A simple method to determine the influence of flanking transmission on the air-borne and impact sound insulation in the field is described. Assuming that the air-borne sound insulation over more than one storey (i_2, i_3 etc.) is due to flanking transmission only, the insulation i_{f_1} due to the flanking transmission between two rooms directly above each other can be determined by subtracting from the insulation over two storeys (i_2) the damping D_1 of the flanking transmission per storey. For impact sound the flanking transmission can be determined in a similar way. The methods of measuring D_1 are described and some results are given. A.

534.833.4

7241. MEASUREMENTS ON SOUND ABSORBERS FOR JET-ENGINE TEST CELLS. R.V.Waterhouse, R.K.Cook and R.D.Berendt.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 688-92 (July, 1956).

The space absorbers were long cylindrical shells of perforated metal, containing glass fibre. The absorbers were to be used in an aero-engine test cell, and these conditions were simulated in the measurements by mounting a few absorbers in a long concrete pipe, so that the cross-sectional ratio (absorber/enclosure) was the same in each case. The direction of propagation of sound was parallel to the axis of the cylinders so that absorption occurred at grazing incidence. The concrete pipe was terminated by a rigid reflector, and the attenuation figures were deduced from the resulting interference pattern using impedance tube theory. The theory was extended to the case of octave bands of noise, when the interference pattern for the mean squared pressure is

$$\langle p^2 \rangle = [\cosh 2ax \sinh(2ax/3)]/(2ax/3) + [\cos(2kx)\sin(2kx/3)]/(2kx/3),$$

where a is the sound attenuation constant, k is the wave number at the centre frequency of the band, and x the distance along the pipe measured from the reflecting end. Experimental results were obtained which followed this pattern, and the required sound attenuation constant was obtained by a graphical method. Measurements were made at low frequencies only, 300 c/s and below. A.

534.839

7242. ON THE LOUDNESS LEVEL OF UNIFORM NOISES. E.Zwicker and R.Feldtkeller.
Acustica, Vol. 5, No. 6, 303-16 (1955). In German.

With the aid of equal loudness contours (loudness in sones as parameter), of the measured width of the frequency groups and reduction of loudness in neighbouring frequency groups, the level of sustained noises with given spectra can be calculated. The aural analysis of a sound into bands of definite size (frequency groups), already demonstrated in respect of hearing threshold, masking and phase detection, appears meaningful in the investigation of noise-levels. Loudness is estimated from the sound intensity in the frequency groups, acting separately at low intensities but with considerable throttling of one group by neighbouring ones at high intensities. A.

534.844.1

7243. ON THE DESIGN OF REVERBERATION ROOMS FOR MEASUREMENT PURPOSES. G.Venzke.
Acustica, Vol. 6, No. 1, 2-11 (1956). In German.

In a series of reverberation rooms of different shapes and sizes the frequency of the occurrence of considerably bent reverberation curves (e.g. double decay) was investigated using the recommendations of German Standard DIN 52212 for the measurement of sound absorption coefficients. At the same time the curvature to be expected of the graphs for rectangular rooms of various sizes was calculated. Besides this, two institutes have independently tested the same absorbent material in three rooms of 83 to 258 m^3 volume. It appears that the uncertainty of measurement increases as the room gets smaller, especially with highly absorbent coverings. Rooms with non-parallel walls are not necessarily better than those of rectangular form. A.

534.862.3

7244. AN APPARATUS FOR THE TEMPORAL LENGTHENING AND PICK-UP OF SOUND RECORDS. A.M.Springer.
Acustica, Vol. 5, No. 5, 279-83 (1955). In German.

An apparatus is described for the temporal lengthening and pick-up of tape records without changing the frequency range. The possible range of lengthening and pick-up and possible applications are discussed. Within ± 30% of the recording time, the pick-up time can be altered without loss of quality. Although on the technical side there are no limits to these times, in practice the apparatus can only be used within specified limits if quality is not to be spoiled. A.

534.88

7245. UNDERWATER ECHO-RANGING. D.G.Tucker.
J. Brit. Instn Radio Engrs, Vol. 16, No. 5, 243-70 (May, 1956).

Reviews the whole field of underwater acoustic echo-ranging and attempts to give a reasonably up-to-date account of the basic principles and many of the engineering aspects of the subject. A.

OPTICS. RADIATION. SPECTRA 535

535.11 : 536.33 : 538.56 : 534.23

RADIATION FROM A SPHERE IN THE PRESENCE OF SELF-ABSORPTION. See Abstr. 6455

535.23.08 : 536.46

7246. A FIVE-BAND RECORDING SPECTRORADIOMETER. C.S.McCamy.
J. Res. Nat. Bur. Stand., Vol. 56, No. 5, 293-9 (May, 1956).

In a project undertaken to determine the properties of flames that might be utilized in the detection of accidental fires in aircraft engine compartments, an instrument was constructed to measure and record the radiant energy emitted by flames in five separate wavelength regions from 0.23 to 2.5 microns. The radiant intensity of several types of hydrocarbon flames was determined in each spectral region. The frequency distribution of the fluctuations in the radiant intensity (flicker) was also determined. A.

535.231 : 536.658

7247. A NEW METHOD OF MEASURING THE TOTAL EMISSIVITY AND THE ACCOMMODATION FACTOR OF A SURFACE. M.Devienne.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 27-8 (July 2, 1956). In French.

The quantities in question can be deduced from the temperature difference, measured under suitable conditions, between an illuminated and a dark plate contained in an isothermal enclosure. E.H.Sondheimer

535.245

7248. IMPROVED TECHNIQUE FOR COATING INTEGRATING SPHERES WITH MAGNESIUM OXIDE. J.M.Dimitroff and D.W.Swanson.
J. Opt. Soc. Amer., Vol. 46, No. 7, 555 (July, 1956).

Describes a device for feeding Mg ribbon manually when smoking an integrating sphere or a plate, so as to produce a thick even layer of MgO. The technique used in the case of the sphere is explained. J.W.T.Walsh

535.3 : 530.162

7249. INFORMATION THEORY IN OPTICS AND TELESCOPY. H.Schober.
Optik, Vol. 13, No. 8, 350-64 (1956). In German.

A comprehensive review. L.Pincherle

535.317

7250. CONTRIBUTION OF ALGEBRAIC METHODS TO THE CALCULATION OF OPTICAL SYSTEMS. F.D.Cruickshank. Rev. Opt., Vol. 35, No. 5, 292-9 (April, 1956). In French.

The main lines of a simple analytical solution of the initial design of triplet photographic objectives are described. The principal results of a recent algebraic treatment of higher-order aberration theory are summarized. Some comments on the application of these methods to problems of practical design are included. A.

535.317.1

7251. EFFECT OF CERTAIN FEATURES OF PHOTO-OPTICAL TRANSMISSION SYSTEMS ON CHARACTERISTICS RELATED TO PICTURE QUALITY IN PROJECTED MOTION PICTURES. A.J.Hill.
J. Opt. Soc. Amer., Vol. 46, No. 9, 691-8 (Sept., 1956).

In an effort to provide an objective guide for the evaluation of different wide-screen photographic projection systems, methods suggested by Schade have been employed to determine the relative ability of different systems to transmit characteristics related to definition and graininess and the relationship analysed between depth of field and projected picture size with an idealized camera obscura. The results have shown Schade's method to be qualitatively in agreement with observational tests and indicate a better method for rating film than the limiting resolving power which has been used heretofore. Depth of field analyses have shown that in order to retain quality in large screen picture projection the illuminance of the scene in front of the camera must be at least proportional to the fourth power of the linear picture dimension. A.

535.317.1

7252. IMAGE QUALITY CRITERIA DERIVED FROM SKEW TRACES. F.A.Lucy.
J. Opt. Soc. Amer., Vol. 46, No. 9, 699-706 (Sept., 1956).

Simple inspection of spot diagrams is often enough to guide design by indicating the optimum imagery which results from variation of system parameters. However, quantitative criteria are necessary for the control of computation by stored-programme machines. Skew traces yield data from which these criteria may be evaluated. In some cases, spot positions are enough. In others, optical path differences are also required. By such means, it is possible to determine what depth of aspherical figuring, if any, is desirable for a given system and what other parameter values optimize the system in the sense of a given test. No universally satisfactory single criterion exists, but maximum reciprocal aberration and minimum required retouching are suggested as being often useful. A.

535.317.1

7253. CONTRAST-TRANSMISSION FUNCTIONS DETERMINED EXPERIMENTALLY FOR ASYMMETRICAL IMAGES AND FOR THE COMBINATION OF LENS AND PHOTOGRAPHIC EMULSION. E.Ingelstam, E.Djurle and B.Sjögren.
J. Opt. Soc. Amer., Vol. 46, No. 9, 707-14 (Sept., 1956).

Equipment is described for obtaining the contrast-transmission curves for two cases not realized by previous designs. First, for asymmetric images, the phases as well as the amplitudes of the Fourier transforms are measured. The relation between the image asymmetry and the acutance of an edge is also discussed. Second, the convolution of the functions of the lens and the photographic emulsion gives the transmission function of a complete system. The principal optical arrangement is undisturbed for the two determinations. In the second case, modulation of the flux is accomplished by polarizers. The differences between the highest and lowest densities are presented directly since density relates well to perception by the eye. These data are then recalculated to light-intensity functions in the emulsion, extending the concept of transmission functions to the emulsion. Some experimental results are given for Panatomic-X emulsion and limitations of the methods are discussed. A.

535.317.1

7254. TRANSMISSION FACTORS AND OPTICAL DESIGN. E.H.Linfoot.
J. Opt. Soc. Amer., Vol. 46, No. 9, 740-52 (Sept., 1956).

This paper is concerned with formulating the requirement which must be fulfilled by a realistic theory of optical image evaluation and with the analytical techniques which enable these requirements to be met to a greater or lesser extent. Some of the shortcomings of old and present-day methods of image assessment are enumerated and the above-mentioned requirements are outlined. The Fourier treatment of optical images is extended to cover systems of fairly large aperture and field working in polychromatic light, and the basic properties of their transmission factors (response functions) are developed. The evaluation of optical images and of optical designs is discussed in terms of these transmission factors. A.

535.317.2

7255. CHARACTERISTICS OF AN IMAGE-FORMING SYSTEM. R.V.Shack.
J. Res. Nat. Bur. Stand., Vol. 56, No. 5, 245-60 (May, 1956).

Two general approaches to the analysis of an image-forming system are considered. One depends on the image of a point object and the other on the Fourier transform of this image. The two are developed independently and then coordinated, a practical characteristic function being determined for each approach. The relative merits of the two approaches are considered. (See also following abstract). A.

535.317.2

7256. OUTLINE OF PRACTICAL CHARACTERISTICS OF AN IMAGE-FORMING SYSTEM. R.V.Shack.
J. Opt. Soc. Amer., Vol. 46, No. 9, 755-7 (Sept., 1956).

The relationships between certain fundamental characteristic functions relating to an optical image-forming system are indicated, some being observable experimentally and others being unobservable. Of the observable characteristics two are especially useful in the analysis of the image-forming properties of the system. One of these represents the image of a point object and the other the Fourier transform of this point image. The two are considered for their practicality as bases for objective laboratory techniques in image evaluation. The transform of the point image is practical as it stands whereas the point image itself is not. A function directly related to the point image and to a number of other simple objects is suggested as a practical representative function. The practical functions are correlated and the relative merits of the two approaches are considered. (See also preceding abstract). A.

535.317.25 : 612.843.633

7257. EXPERIMENTS CONCERNING THE INTERRELATIONSHIP OF RESOLVING POWER AND RECOGNITION. K.Leistner.
J. Opt. Soc. Amer., Vol. 46, No. 9, 686-90 (Sept., 1956).

An attempt was made to evaluate in terms of recognition the performance of several lenses of equal focal length and aperture, but of different design. Some lenses required a detailed study because of the presence of two resolution maxima. Photographic measurements of the contrast rendition were made by means of the National Bureau of Standards' continuous-tone test chart. For one lens the measurements were repeated photoelectrically. With the same lens recognition tests were made using pictures of natural objects as targets. They did not reveal a clear relationship with either resolution or contrast rendition. A.

535.317.7

7258. COMPARISON OF THREE PHOTOELECTRIC METHODS OF IMAGE EVALUATION. V.Carpenter and R.E.Hopkins.
J. Opt. Soc. Amer., Vol. 46, No. 9, 764-7 (Sept., 1956).

A photographic lens has been analysed by three methods of photoelectric photometry: a spot scanner, a knife-edge scan, and a sine wave scanner. The study indicates the superiority of the sine wave response method for evaluating how the lens

ill reproduce sine waves. The knife-edge scan, however, ontains all the information and for lens testing may be the mplest test yet described. A.

535.323

259. ON THE REFRACTIVE INDICES OF BINARY OXIDE LASSES. A.Winter.
R. Acad. Sci. (Paris), Vol. 242, No. 25, 2931-3 (June 18, 956). In French.

Values of the R.I., $n(A_KO_L)$, for glasses A_KO_L where is an element of group III, IV or V, fit the relation: $A_KO_L) = n_0 + (\text{constant}) \times LM_A$; M_A is the atomic weight A, and n_0 has the value 1.24 which is close to the R.I. of quid oxygen. The R.I.'s of the glasses Tl_2O_3 and Bi_2O_3 have een measured, and the values found, 2.3 and 2.45 respectively, e claimed to fit the relation perfectly. R.S.Pease

535.323

260. CERTAIN OPTICAL CONSTANTS OF BASIC GLASSES ADE FROM OXIDES, SULPHIDES, SELENIDES AND TELL-RIDES. A.Winter.
.R.Acad. Sci. (Paris), Vol. 242, No. 26, 3057-9 (June 25, 956). In French.

A table giving all the known values of the refractive in-ices and dispersion coefficients of pure basic glasses (e.g. eO_2, Sb_2S_3, SeS). The entries are displayed according to the eriodic group of the metal and certain regularities and rules re noted. R.O.Davies

535.324 : 541.182.6

261. THE REFRACTIVE INDEX OF COLLOIDAL SOLS. .Chou and M.Kerker.
. phys. Chem., Vol. 60, No. 5, 562-4 (May, 1956).

The refractive index of sulphur hydrosols of various par-icle sizes has been measured and the intrinsic refractive ndex computed. The experimental values are in agreement vith the requirements of the Zimm—Dandliker theory (Abstr. 0983/1954). A.

535.33.07 : 535.375.5

262. SODIUM VAPOR LAMP RAMAN EXCITATION SOURCE OR THE STUDY OF COLORED COMPOUNDS. F.T.King and .R.Lippincott.
. Opt. Soc. Amer., Vol. 46, No. 8, 661-2 (Aug., 1956).

Four lamps are used in a Hilger-type source with filters f potassium dichromate and the potassium salt of the tetra-ulphonic acid of copper phthalocyanine. The Raman frequen-ies are reported for nitrobenzene, iron pentacarbonyl and iazocyclopentadiene. G.F.Lothian

535.33.07

7263. ON GENERALLY VALID EXACT FORMULAE FOR "SPECTRAL SLIT WIDTH". V.v.Keussler.
Optik, Vol. 13, No. 7, 317-21 (1956). In German.

A calculation of the entrance and exit slit widths in terms of wavelength for a single prism, not necessarily used at mini-mum deviation. Differences from Williams' formula (Abstr. 1802/1948) are discussed. S.T.Henderson

535.33.07

7264. DESCRIPTION OF AN INTENSIMETER. G.Mannino and A.Mammano.
Ricerca sci., Vol. 25, No. 11, 3092-5 (Nov., 1955). In Italian.

A semiautomatic instrument which transforms the profiles of spectra, recorded by a microphotometer, from transpar-encies to intensities. A.

535.33.07

7265. UTILIZATION IN THE FAR ULTRAVIOLET OF AN EMITTING LAMP OF THE SCHÜLER TYPE. T.El Khalafawi and A.Johannin-Gilles.
J. Phys. Radium, Vol. 17, No. 4, 372-3 (April, 1956). In French.

A modification of Schüler's lamp is figured and described. The vapour to be studied is carried in He, A or H_2, and the discharge tube is directly connected with the spectrograph without an intervening window. Continuous pumping maintains the low pressure required. S.T.Henderson

535.33.07 : 535.243

7266. AUTOMATIC RECORDING DOUBLE BEAM INFRA-RED SPECTROPHOTOMETER. K.Kudo.
Sci. of Light (Tokyo), Vol. 4, No. 2, 85-104 (Nov., 1955).

The prism is of 60° Littrow-mounted rock salt, 8 x 6 cm faces. A comb with eight teeth is used as attenuator. Scanning speed varies from 15 minutes to 8 hours; response time is from 7 sec to 21 sec for full scale. Percentage of transmission is recorded with an accuracy of ±1% and wavelength with an accuracy of ±0.01 μ. Linearity, scanning speed, gain and filter, slit width and resolution are described in detail. A.

535.33.07

7267. ON THE ABERRATION OF OPTICAL SYSTEM USED IN INFRARED SPECTROMETER. K.Kudo.
Sci. of Light (Tokyo), Vol. 4, No. 2, 105-12 (Nov., 1955).

The aberration is discussed, using Seidel's aberration formula. It is shown that, when a collimating mirror is used off-axially, a paraboloidal mirror is better than a spherical mirror, and when a spherical mirror is used, the optical arrangement should be carefully planned and set. A.

535.331

7268. PRELIMINARY REPORT ON THE ISOTOPIC STRUC-TURE OF THE CADMIUM PRIMARY STANDARD OF WAVE-LENGTH. J.H.Wise and K.L.Vander Sluis.
J. Opt. Soc. Amer., Vol. 46, No. 8, 587-9 (Aug., 1956).

With enhanced samples of the eight isotopes of cadmium in electrodeless discharge tubes, measurements of the centre of gravity line position of λ6438 have been made to better than one part in 25 million or to about 0.0003 A. The estimated resolution, based on Doppler broadening, was 500 000. The observed shifts, compared to a similar normal cadmium source, have been treated by a least squares analysis of a matrix multiplication by the ORACLE. The preliminary results indicate a difference for the extreme masses of about 0.008 A, which is comparable with the half-width of the red line in an atomic beam source. With the exception of mass 108, there is a regular increase in wavelength for the even mass numbers. The odd mass isotopes appear to give anomalous shifts, falling near the shift for the adjacent larger even mass. The principal source of error in the procedure is associated with apparent shifts due to differences in density of the patterns. A.

535.331

7269. MULTIPOLE LINES IN THE FIRST SPECTRUM OF POLONIUM I. S.Mrozowski.
J. Opt. Soc. Amer., Vol. 46, No. 8, 663 (Aug., 1956).

Lines obtained by Charles, Hunt, Pish and Timma (Abstr. 9547/1955) are classified. G.E.Brown

535.331

7270. THE SPECTRUM OF DOUBLY IONIZED MANGANESE (Mn III). O.García Riquelme.
An. Real Soc. Españ. Fís. Quím., Vol. 52 (A), No. 3-4, 75-84 (March-April, 1956). In Spanish.

Wavelengths, measured with a quartz prism spectrograph and with a concave grating, ranging from 2211 to 9300 A, and visually estimated relative intensities are given for about 2000 lines, together with their character (whether sharp, diffuse, asymmetric, etc.). L.Pincherle

535.333

7271. EMISSION BAND SPECTRA OF NITROGEN. THE LYMAN—BIRGE—HOPFIELD SYSTEM. A.Lofthus.
Canad. J. Phys., Vol. 34, No. 8, 780-9 (Aug., 1956).

The near ultraviolet part of the emission spectrum of nitro-

gen has been photographed under high resolution. Thirteen bands of the $a^1\Pi_g - X^1\Sigma_g^+$ system (Lyman–Birge–Hopfield) have been analysed and new vibrational and rotational constants obtained. Combining the observed data with those obtained by Stoicheff from the Raman spectrum of nitrogen, refined equilibrium constants for the ground state were obtained. The predissociation in the $a^1\Pi_g$ state was observed. A.

535.333 : 539.132

7272. MAGNETIC HYPERFINE STRUCTURE IN BISMUTH HYDRIDE AND DEUTERIDE. E.Hulthén and H.Neuhaus.
Phys. Rev., Vol. 102, No. 5, 1415-16 (June 1, 1956).

Using the spectroscopic immersion method (Abstr. 2639/1955) a region of the Q branches of the (0, 0) bands in BiH and BiD near 6118 A was resolved. Hyperfine structure attributable to the $^1\pi$ state was detected with coupling of the Bi nucleus to J with the coupling constant A = 0.0540 in the interpretation corresponding to Hund's case a_β. D.H.Whiffen

535.333 : 523.67

7273. ANALYSIS OF THE SPECTRUM OF AMMONIA AND THE SPECTRA OF COMETS. P.Proisy.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2920-2 (June 18, 1956). In French.

Main characteristics of the three groups of lines comprising the α-band of NH_3 and their response to changes in the physical conditions of excitation are indicated. In cometary spectra, certain NH_2 emission bands in the visible spectrum of ammonia (first observed in absorption by Herzberg and Ramsay, 1953), viz. 4925, 5429, 5976 and 6300 A are always present; whilst others, e.g. at 4719, 5166 and 5707 A have never been observed. D.R.Barber

535.333 : 535.343

7274. INFRARED SPECTRUM OF HYDROGEN FLUORIDE. G.A.Kuipers, D.F.Smith and A.H.Nielsen.
J. chem. Phys., Vol. 25, No. 2, 275-9 (Aug., 1956).

The infrared vibration-rotation spectrum of HF has been re-examined through J = 11 for the fundamental, and through J = 8 for the first overtone. Five lines of the pure rotational spectrum of HF (J = 10, 11, 12, 14, 15) have been observed in absorption and emission between 15 and 24μ. Extension of the measurement to larger J values makes it possible to observe the effect of the term $H_v J^3 (J+1)^3$ in the energy, and to obtain H_v. With the new data the molecular constants have been re-evaluated by I.B.M. machine. These constants when used with the energy expression permit accurate prediction of the observed energy levels. A.

535.333

7275. ELECTRON EXCITATION FUNCTIONS OF THE FIRST NEGATIVE BANDS OF N_2^+. D.T.Stewart.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 437-40 (June, 1956).

A photoelectric spectrophotometer has been developed for studying the feeble light emitted from a gas at low pressure excited by an electron beam of known energy in an equipotential box. The probabilities of excitation of the (0,0), (0,1) and (0,2) negative bands of the nitrogen molecular ion have been measured. The maximum cross-section for formation of the v = 0 level of the upper state involved, $B^2\Sigma$, from the ground state of the neutral molecule $X^1\Sigma_g^+$ was found to be $(9.5 \pm 1.0) \times 10^{-18}$ cm^2 and occurs for electrons of approximately 100 eV energy. A.

535.337

7276. GENERAL FORMULAS FOR LEAST SQUARES REDUCTION OF ZEEMAN DATA. K.L.Vander Sluis.
J. Opt. Soc. Amer., Vol. 46, No. 8, 605-8 (Aug., 1956).

At least squares analysis is applied to the reduction of complete and incomplete Zeeman patterns. The resulting general formulae provide a simple systematic computation of the "best values" of the Landé g factors and a measure of their precision. A.

535.338.332 : 539.152.2

7277. A NOTE ON OPTICAL HYPERFINE STRUCTURE IN Cd II. F.M.Kelly and J.B.Sutherland.
Canad. J. Phys., Vol. 34, No. 5, 521-2 (May, 1956).

The hyperfine structure of the Cd II resonance lines at 2144 and 2265 A are resolved with a Fabry–Perot interferometer and the separations for the odd isotopes (both I = 1/2) are 0.519 ± 0.004 and 0.491 ± 0.007 cm^{-1} respectively for the two lines. The separate isotopes are not resolved but the average value of the nuclear moment is -0.62 ± 0.02 n.m. if the Fermi–Segrè factor is used; this agrees with the nuclear induction value – 0.608 n.m. D.H.Whiffen

535.338.33:

7278. HYPERFINE STRUCTURE OF THE SPECTRUM OF Cu I AND TEST OF THE HYPERFINE STRUCTURE FORMULAS. K.Murakawa.
J. Phys. Soc. Japan, Vol. 11, No. 7, 774-7 (July, 1956).

The hyperfine structure (h.f.s.) of the levels $3d^9 4s^2\ ^2D_{5/2}$ and $^2D_{3/2}$ was measured and compared with the usual h.f.s. formulae for d-electrons, and a discrepancy between theory and experiment was found. This can be phenomenologically interpreted by assuming that the values of $1/r^3$ are different for $3d_{5/2}$- and $3d_{3/2}$-electrons, namely $1/r^3 = 7.4$ and 8.0 for $3d_{5/2}$- and $3d_{4/2}$-electrons respectively, where r is measured in units of hydrogen atom radius. A

535.338.333

7279. ISOTOPE SHIFT IN THE SPECTRA OF Ne II AND W I. K. Murakawa.
J. Phys. Soc Japan, Vol. 11, No. 7, 778-80 (July, 1956).

The isotope shift in the transition 3s–3p in the spectrum of Ne II (Ne^{22}–Ne^{20}) was observed, using a liquid-air cooled hollow cathode. The shift in the doublet spectrum of the ^3P system was found to be of the order of 0.2 cm^{-1} and larger than that in the quartet spectrum or the ^1D system. The component due to the rare isotope W^{180} was detected in the line λ 4269 of the spectrum of W I, and the ratio of the distances of the neighbouring even isotopes was found to be $\Delta(186\text{-}184) : \Delta(184\text{-}182) : \Delta(182\text{-}180) = 1 : 1.206 \pm 0.010 : 0.88 \pm 0.07$. A.

535.338.4

7280. ON A NEW BAND SYSTEM OF THE OH RADICAL OR ION. H.Schüler and A.Michel.
Z. Naturforsch., Vol. 11a, No. 5, 403-6 (May, 1956). In German.

A new band system has been observed in the region 2250 to 2545 A in a low-current discharge through water vapour. Evidence is given to suggest that the lower electronic state of the new bands is identical with the lower state of the visible bands, which are believed to arise from a transition $B^2\Sigma^+ - A^2\Sigma^+$ in OH. (see Abstr. 4300/1956). Difficulties of this interpretation are discussed. R.F.Barrow

535.34.07

7281. SODIUM CHLORIDE AND CALCIUM FLUORIDE WINDOWS FOR HIGH-PRESSURE INFRARED SPECTROSCOPY. R.W.Parsons and H.G.Drickamer.
J. Opt. Soc. Amer., Vol. 46, No. 6, 464 (June, 1956).

NaCl is only useful for pressures below 2000 atm. Annealed CaF_2 may be used once only up to 11 000 atm. G.F.Lothian

535.34.07

7282. APPARATUS FOR OBTAINING OPTICAL ABSORPTION SPECTRA AT PRESSURES TO 6000 BARS. D.S.Hughes and W.W.Robertson.
J. Opt. Soc. Amer., Vol. 46, No. 7, 557-8 (July, 1956).

Constructional details are given of the method of using an absorption cell, with sapphire windows 0.4 in. thick, connected to a hydraulic ram. A difficulty is that O-rings of neoprene etc. tend to dissolve in the liquid. G.F.Lothian

535.34.07

83. INFRARED MEASUREMENTS FROM 50 TO 125 ICRONS. E.K.Plyler and N.Acquista.
Res. Nat. Bur. Stand., Vol. 56, No. 3, 149-53 (March, 1956).

A prism spectrometer has been changed to a long wave-ngth grating spectrometer by removing the prism and by re-acing the Littrow mirror with a grating. Gratings of 320 and 30 lines per inch were used for the region 50 to 125 microns. thermocouple with a crystal quartz window served as the etector. Stray radiation was greatly reduced by the use of eflection filters. Three types of reflection filters were found be efficient. They were gratings with 2000 lines per inch, oughened silver mirrors and reststrahlen plates of NaCl, KBr nd CsBr. The absorption lines of water vapour were used to alibrate the spectrometer. The spectra of several substituted hylenes and ethanes have been measured and absorption bands ave been found between 50 and 100 microns. A.

535.342

284. TOTAL ABSORPTION AND OVERLAPPING EFFECT UE TO TWO SPECTRAL LINES OF EQUAL WIDTH AND TRENGTH. F.Reiche.
. Opt. Soc. Amer., Vol. 46, No. 8, 590-7 (Aug., 1956).

The total absorption due to two narrow, identical spectral nes, of equal strength and width, is computed as a function f two parameters, γ and σ, where γ characterizes the fre-uency distance of the two lines, while σ is proportional to the roduct of the number of absorbing particles (per unit volume) nd the thickness of the absorbing layer. This represents the o-called "curves of growth", for the case in question. Of pecial interest, besides the two limiting cases, $\gamma \to 0$ and $\to \infty$, is the influence of the overlapping effect for relatively mall γ. A.

535.343

285. NEAR ULTRAVIOLET ABSORPTION SPECTRUM OF TROPOLONE VAPOR. S.Imanishi and M.Ito.
. chem. Phys., Vol. 24, No. 6, 1272 (June, 1956).

Measurements have been made in the 3375-3915 A region t temperatures between 40 and 145°C. The strongest band at 3699 A is assumed to be the 0,0 transition and the vibrational requencies represented by the strong bands on the violet side f this 0,0 band are tabulated and compared with Raman re-sults. G.I.W.Llewelyn

535.343

286. SPECTRA OF SOME AMINO ACIDS, PEPTIDES, NUCLEIC ACIDS, AND PROTEIN IN THE VACUUM ULTRA-VIOLET. J.W.Preiss and R.Setlow.
. chem. Phys., Vol. 25, No. 1, 138-41 (July, 1956).

The absorption spectra of several amino acids, nucleic acids, and a protein have been obtained down to 1450 A. The samples were in the form of thin films supported on calcium luoride. All compounds studied had characteristic absorption spectra below 2000 A. In some cases, e.g., tryptophan, the absorption spectrum of the solid film showed pronounced difference from the spectrum of the molecules in solution. At 1900 A, the absorption coefficient of the protein chymotrypsin is the sum of the molecular extinction coefficients of its components. The instrument used was a vacuum grating-monochromator with hydrogen discharge light source. A.

535.343

287. ABSORPTION SPECTRUM OF THE EXCESS SILVER IN THE LOW TEMPERATURE AND THE HIGH TEMPERATURE MODIFICATIONS OF SILVER IODIDE. P.N.Kokhanenko and L.V.Grigoruk.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 676-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 530-2 (May, 1956).

It is demonstrated that maxima at 4290 and 3340 A in the absorption spectrum of AgI, which are due to atoms or ions of the excess silver, disappear when the AgI is transformed into the high temperature modification, and reappear during the reverse transformation into the low temperature modification. The presence of the excess silver increases the transition temperature of one modification of AgI into the other by 5-15°C. A.

535.343

7288. THE STRENGTHS, WIDTHS, AND SHAPES OF INFRARED LINES. I. GENERAL CONSIDERATIONS.
W.S.Benedict, R.Herman, G.E.Moore and S.Silverman.
Canad. J. Phys., Vol. 34, No. 8, 830-49 (Aug., 1956).

Discusses methods by which the strengths, widths, and shapes of spectral lines may be derived from measurements obtained with spectrometers whose resolving power is sufficient to separate individual spectral lines but is insufficient to portray accurately the true line contour. The Lorentz shape for collision-broadened lines is taken as a first approximation to the true line shape for most of the discussion. Numerous corrections that should be taken into account in interpreting experimental data are included. These arise from instrumental effects, overlapping of the individual lines, and deviations from the Lorentz shape. The three types of measurements discussed in some detail are the measurements of the "equivalent width", of the apparent breadth of a line at high optical density, and of the apparent extinction of a line or group of lines at the troughs between lines and in the wings. It is shown how these various types of measurements can be combined to yield the line strength, width, and shape. A.

535.343

7289. THE STRENGTHS, WIDTHS, AND SHAPES OF INFRARED LINES. II. THE HCl FUNDAMENTAL.
W.S.Benedict, R.Herman, G.E.Moore and S.Silverman.
Canad. J. Phys., Vol. 34, No. 8, 850-75 (Aug., 1956).

The methods described in Pt 1 are applied in detail to the determination of strengths, widths, and shapes of the vibration—rotation lines of the 1-0 bands of HCl^{35} and HCl^{37} observed at 300° K. The variation of the line strengths with rotational quantum numbers is compared with theory to yield a value of the ratio of the permanent electric dipole moment to the product of the effective charge and the equilibrium internuclear distance of $+0.988 \pm 0.022$. The band strength was found to be 130 cm^{-2} atm^{-1} which should be good to ~5%. A marked variation of line width with rotational quantum number has been found which follows approximately the Boltzmann population distribution. This result is compared with a theory that considers resonant dipole—dipole and billiard ball interactions. The line widths were found to vary from ~0.25 cm^{-1} atm^{-1} for J = 3 to ~0.07 cm^{-1} atm^{-1} for J = 13. Evidence is obtained that at distances greater than ~1.5 cm^{-1} from the line centres the absorption is greater than is given by the Lorentz line shape. In the wings of the lines the absorption is better represented by a line shape varying as $(\nu - \nu_0)^{-\eta}$ where $\eta \sim 1.8$. A.

535.343 : 539.132

7290. NEAR INFRARED SPECTRUM OF DCl.
B.H.Van Horne and C.D.Hause.
J. chem. Phys., Vol. 25, No. 1, 56-9 (July, 1956).

The first (2—0) and second (3—0) overtones of DCl have been obtained with high dispersion in the 2.4 and 1.6 micron regions. Values for the rotational constants B_e, I_e, and r_e are essentially in agreement with those obtained by Pickworth and Thompson for the fundamental band. The molecular constants obtained are:

	DCl^{35}	DCl^{37}
B_e	5.449_0 cm^{-1}	5.432 cm^{-1}
I_e	$5.135_4 \times 10^{-40}$ g. cm^2	$5.151_6 \times 10^{-40}$ g. cm^2
r_e	$1.274_4 \times 10^{-8}$ cm	$1.274_5 \times 10^{-8}$ cm
ω_e	2144.77 cm^{-1}	2141.20 cm^{-1}
$\omega_e x_e$	26.92 cm^{-1}	26.99 cm^{-1}
$\omega_e y_e$	0.036 cm^{-1}	0.063 cm^{-1}

These agree closely with the values calculated from the data for HCl. A.

535.343

7291. K-STRUCTURE OF THE PURE ROTATION LINE J = 15→16 OF AMMONIA. A.Hadni.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2927-9 (June 18, 1956). In French.

Eleven components of structure are found in the range 305-317 cm^{-1}. The frequencies are compared with calculated values. G.F.Lothian

535.343

7292. NEAR INFRARED SPECTRA OF DIBORANE, PENTABORANE, AND DECABORANE. P.R.Pondy and H.C.Beachell.
J. chem. Phys., Vol. 25, No. 2, 238-41 (Aug., 1956).

Spectra have been examined at high resolution. Assignment of the observed frequencies for diborane have been made. Pentaborane has been subjected to group theoretical reduction considerations to ascertain which overtone frequencies are i.r. active for this molecule. On the basis of the data obtained, bond energies, bond distances, and force constants have been calculated for the B—H bond in each of these molecules. Spectral structure comparisons of diborane, ethane, and ethylene have been made. A.

535.343

7293. INFRARED SPECTRA OF HYDROGEN CYANIDE AND DEUTERIUM CYANIDE. H.C.Allen, Jr., D.Tidwell and E.K.Plyler.
J. chem. Phys., Vol. 25, No. 2, 302-7 (Aug., 1956).

The infrared spectra of HCN and DCN have been investigated in the region 1900 to 8000 cm^{-1}. Twenty-two bands of HCN and eighteen bands of DCN were measured. The newly measured bands together with previously known bands enable a complete determination of the vibrational anharmonic constants for the two molecules. A third-order resonance between levels of the type $(v_1, v_2^{\,l}, v_3)$ and $(v_1+3, v_2^{\,l}, v_3-2)$ is shown to be present in the HCN vibrational energy-level system. A.

535.343 : 548.736.4

7294. CRYSTAL STRUCTURE OF BRUCITE AND PORTLANDITE IN RELATION TO INFRARED ABSORPTION.
R.T.Mara and G.B.B.M.Sutherland.
J. Opt. Soc. Amer., Vol. 46, No. 6, 464 (June, 1956).

Low-temperature measurement of the infrared spectrum of brucite [$Mg(OH)_2$] shows that it is possible to interpret the fine structure noted in the region 2.3-3.5 μ without invoking a larger unit cell than that observed from X-ray analysis. This is contrary to the explanation previously proposed by the authors (Abstr. 279/1954). G.I.W.Llewelyn

535.343

7295. VIBRATIONAL SPECTRA OF FORMYL FLUORIDE AND d-FORMYL FLUORIDE. H.W.Morgan, P.A.Staats and J.H.Goldstein.
J. chem. Phys., Vol. 25, No. 2, 337-41 (Aug., 1956).

The vibrational spectra of HCOF and of DCOF have been examined in the gas and solid phases by infrared techniques and in the liquid phase through the Raman effect. Of the six expected fundamentals for a molecule of point group C_s, frequencies have been assigned to the five planar vibrations and a tentative assignment made for the nonplanar vibration. A normal coordinate analysis was applied to the A' vibrations of HCOF, neglecting all interaction terms, and a set of force constants obtained which predict reasonably well the isotopic shifts in DCOF. A.

535.345 : 537.311.33

7296. OPTICAL AND ELECTRICAL MEASUREMENTS ON CAESIUM—ANTIMONY FILMS OF DIFFERING COMPOSITION. G.Wallis.
Ann. Phys. (Leipzig), Vol. 17, No. 6-8, 401-16 (1956). In German.

Absorption measurements (n and k) and electrical conductance as a function of film thickness and temperature are reported for Cs—Sb layers of varying composition. The absorption edge for Cs_3Sb is of complex form, the main edge lying at 0.8 μ and a tail band at about 1-1.2 μ, in approximate agreement with theory. Measurements were made on Cs, Sb, CsSb, and Cs_3Sb out to 1.8 μ. The high-temperature activatio energy of Cs_3Sb is of order 1.1-1.2 eV and the low-temperature value 0.6 eV. The results are discussed in terms of band diagrams previously postulated for Cs_3Sb. C.A.Hogarth

535.37

7297. SOME OPTICAL PROPERTIES OF NEW ZnS PHOSPHORS ACTIVATED BY RARE EARTH METALS.
Z.A.Trapeznikova and V.V.Shchaenko.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 2, 230-2 (1956). In Russian.

Deals with phosphors activated with Nd, Pr, Sm, Dy, Er Tm, and Eu prepared in H_2S, NH_3, N_2 and in vacuo. Spectra o the phosphors activated by Nd, Tm and Dy in the three gases and in vacuo are shown. Similarities between the spectra of those prepared in H_2S and NH_3 and differences from those pre pared in N_2 and in vacuo are indicated. It is concluded that differences are due to the traces of ZnO in phosphors prepare in H_2S and in NH_3. Excitation spectra show a quantum yield in dependent of wavelength of excitation in the region 2500-3200 A but maxima appear in the region 3200-4200 A characteristic o each activator. The maxima at about 3300 A are independent o the atmosphere of preparation. In the phosphors activated by Nd, Pr, Dy and Er, line-like absorption occurs in the visible region and its intensity alters little with temperature. In the long-wave part of the excitation spectrum narrow lines of emission appear. It is suggested that the excitation at about 3300 A occurs in the base ZnS and is handed on to the rare earth ion i.e. the emission is sensitized luminescence with the centres responsible for the initial excitation being the same a those in blue-luminescent ZnS. The greater efficiency with addition of NH_4Cl is explained as due to shift of the absorptio maximum and the consequent greater efficiency of the energy transfer. J.Ewles

535.37

7298. POLARIZATION OF LUMINESCENCE IN MONOCRYSTALS. B.H.Grechushnikov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 2, 457-9 (1956). In Russian.

Feofilov (Abstr. 7009-10/1954) considered the polarized luminescence in CaF_2 and in alkali halides as being related to the degree of polarization of a system of oscillators distribute in a definite way in an isotropic crystal medium. Here uniaxial crystals are considered, absorption and emission being related to the dipoles arranged in a definite way in the crystal. Formulae and diagrams showing the degree of polarization for different azimuths are obtained. J.Ewles

535.37

7299. DIRECT MEASUREMENT OF THE TOTAL LIGHT OF RAPIDLY DECAYING PROCESSES OF LUMINESCENCE.
N.A.Tolstoĭ and I.A.Litvinenko.
Zh. éksper. teor. Fiz., Vol. 29, No. 4(10), 507-15 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 420-7 (May, 1956).

A new, objective method is proposed for the direct measurement of L_p and L_z for rapidly proceeding luminescent processes. The relationship of the area above the curve of fluorescent rise L_p to the area under the curve of fluorescent decay L_z can serve as the criterion for the selection of one or another theory of phosphorescence, since the various theories generally speaking, predict different magnitudes for L_p/L_z. The measurement of L_p/L_z for a quenched ZnS(Cu) phosphor indicates the inapplicability of a theory based on a bimolecular mechanism of luminescence and a monomolecular mechanism of decay. A.

535.37

300. GAMMA-RAY AND PHOTOLUMINESCENCE YIELDS F ORGANIC CRYSTALS. Z.A.Chizhikova and M.D.Galanin. h. éksper. teor. Fiz., Vol. 30, No. 1, 187-8 (1956). In ussian.

The spectra are the same under both excitations. The m of the experiments was to see if the fraction of absorbed nergy used to excite the luminescence was the same for fferent substances. The relative yield from γ-rays was easured by two different methods — by the mean intensity nd by recording the individual scintillations. The source excitation was Co^{60}. Results are given for toluene, stilbene, aphthalene, terphenyl, dibenzyl, KI(Tl), NaI(Tl) and aphthalene—anthracene mixtures. The values for fraction f the absorbed energy obtained by two methods did not differ y more than 15% except for KI(Tl) scintillations where the ng-period phosphorescence accounts for the difference.

J.Ewles

535.371

301. THE YIELD OF ANTI-STOKES FLUORESCENCE OF ERY VISCOUS DYE SOLUTIONS. R.Drabent and D.Frackoviak.
cta phys. Polon., Vol. 14, No. 6, 447-54 (1955).

The results of measurement of the relative yield of fluorescein in glycerol and glucose are given. In the first case he yield decreases with increasing wavelength of the exciting ight, in the second case, however, it does not — remaining ractically constant. An explanation of the experimental results is put forward, according to which the course of the ield as a function of the exciting wavelength depends on the elative concentration of non-luminescent dimers. A.

535.371

302. OPTICS OF POWDER MATERIALS. Z.Bodó and .Hangos.
cta phys. Hungar., Vol. 5, No. 3, 295-304 (1955).

A calculation for the intensity variation of light emitted by luorescent powder layers of definite thickness is described. he absorption of the exciting light and the emission of the luorescent light is calculated by the plane parallel plate approxmation, the actual coating being also taken into account. The xperiment is in good agreement with the results of the calcuation. A.

535.371

7303. ON TWO FLUORESCENCE EMISSIONS FROM CADMIUM IODIDE. G.Monod-Herzen.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2830-1 (June 11, 1956). In French.

Pure cadmium iodide is stated to show a weak green luminescence which changes to a yellow emission and is enhanced by the presence of lead iodide in solution. The complex conditions in crystals obtained from solution, particularly the presence of separated lead iodide, are discussed in relation to the use of cadmium iodide fluorescence as a detector for lead. G.F.J.Garlick

535.371 : 539.132

7304. FLUORESCENCE AND INTERNAL ROTATION: THEIR DEPENDENCE ON VISCOSITY OF THE MEDIUM. G.Oster and Y.Nishijima.
J. Amer. Chem. Soc., Vol. 78, No. 8, 1581-4 (April 20, 1956).

Substances possessing substituted phenyl groups which are capable of internal rotation increase their fluorescence with increasing viscosity of the medium. The fluorescence yield Φ of auramine O, a substituted diphenylmethane dye, measured in glycerol at various temperatures and in dextrose—glycerol—water mixtures at room temperature followed the relation $\Phi = (\eta/T)/[\alpha+\beta(\eta/T)]$ where α and β are constants, η is the viscosity and T is absolute temperature. The results are interpreted as being due to one of the fluorescence quenching steps passing via a rotational diffusion process. It is calculated that this step takes place if during the period of excitation of the light-excited dye the groups on the molecule have rotated relative to one another by more than 2^0. A.

535.371

7305. KINETICS OF LUMINESCENCE QUENCHING IN LIQUID SCINTILLATORS. B.L.Funt and E.Neparko.
J. phys. Chem., Vol. 60, No. 3, 267-9 (March, 1956).

The kinetics of quenching in solutions containing dissolved oxygen have been studied. A mechanism is postulated which is in good agreement with the experimental data for the eight systems reported. The experimental rate constants have been compared with rates of collision obtained from simple kinetic theory. Such a comparison indicates an extremely efficient collisional mechanism with almost every collision effectively deactivating the solute molecule. A.

535.371

7306. DECAY TIME OF ZnS(Ag) AND PREPARATION OF A ZnS(Ag) DETECTOR. B.Chinaglia, F.Demichelis and R.A.Ricci.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 134-7 (July, 1956). In Italian.

The decay time of the light pulse produced in a ZnS(Ag) scintillator by α-particles from a radium source was measured with a fast oscillograph. A value of $7\text{-}8 \times 10^{-8}$ sec was obtained. A detailed description of the preparation of the ZnS(Ag) detector is given. P.Rothwell

535.371

7307. LONG-TIME COMPONENTS IN THE EMISSION OF LUMINESCENT MATERIALS. H.Kallmann and G.M.Spruch.
Phys. Rev., Vol. 103, No. 3, 580-4 (Aug. 1, 1956).

The decay of light emission in the time range from 150 microseconds to 20 milliseconds, caused by excitation by single high-energy electrons and alpha-particles at room temperature, was studied for several different types of phosphors. The zinc cadmium sulphides investigated were found to exhibit emission under alpha-particle excitation longer than can be accounted for by the bimolecular decay theory, indicating that traps are of importance even with this kind of excitation. Several alkali halides also emit a considerable part of their total light in this interval when excited by alpha-particles. Of the organic phosphors studied, only diphenylacetelene showed measurable emission in this time range, and only when excited by alpha-particles. A phosphor with a very large number of traps (Standard 7) had practically no emission in the time range investigated. A.

535.371 : 537.312.5 : 548.7

7308. SOME OPTICAL AND ELECTRICAL MEASUREMENTS ON BLUE FLUORESCENT ZnS-Cl SINGLE CRYSTALS. F.A.Kröger.
Physica, Vol. 22, No. 8, 637-43 (Aug., 1956).

For hexagonal ZnS-Cl single crystals, measurements of the intensity of luminescence, photoconductivity, Hall effect, thermoluminescence and thermoconductivity have been carried out. Analysis of the experimental results provides the following data: (a) the electron mobility at room temperature $\mu_C \cong 120\ cm^2\ V^{-1}\ sec^{-1}$; the mobility decreases with increasing temperature, (b) the depth of traps formed by Cl^- is $\epsilon_{Cl^-} = 0.24 \pm 0.02$ eV, (c) the frequency of escape from Cl^- traps $s = 7 \times 10^4\ sec^{-1}$, (d) the capture cross-section of the Cl^- traps is $\sigma \cong 3 \times 10^{-21}\ cm^2$, (e) recombination levels ("killers") are situated ~ 0.7 eV below the conduction band. A.

535.371

7309. ON THE EXCITATION OF PHOSPHORS BY ACTIVE GAS. W.Hanle and H.Niermann.
Z. Naturforsch., Vol. 11a, No. 5, 395-7 (1956). In German.

The temperature dependence of luminescence of various phosphors is measured for excitation by electrons, ultraviolet light and by active nitrogen. In the region where ultraviolet

and electron excited emission falls with rising temperature that excited by nitrogen rises to a maximum and then falls away for several phosphors. The ability to excite phosphors by active gas is dependent on removal of surface gas atoms at a sufficiently high temperature. No excitation of arsenates and germanates, or of silver activated zinc sulphide was obtained with active nitrogen. G.F.J.Garlick

535.371

7310. MEASUREMENT OF FLUORESCENCE DECAY TIMES WITH A FLUOROMETER HAVING VARIABLE LIGHT PATH. A.Scharmann.
Z. Naturforsch., Vol. 11a, No. 5, 398-402 (1956). In German.

The decay time of fluorescence is measured for trypaflavin in polyvinylalcohol sheet, for pseudo isocyanine and for anthracene in polystyrene. Trypaflavin behaves in a similar manner to that in liquid solution. Anthracene in polystyrene specimens of 5 mm thickness shows the increased decay time already known for anthracene crystals and due to reabsorption and emission of fluorescence. G.F.J.Garlick

535.371 : 539.132

THE DEVELOPMENT OF A FLUORIMETRIC METHOD OF STUDYING THE DURATION OF THE EXCITED STATE OF MOLECULES. See Abstr. 6820

535.373

7311. PHOSPHORESCENCE OF CRYSTALLINE NAPHTHALENE AT 20° K. A.Zmerli, L.Pesteil and P.Pesteil.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2822-5 (June 11, 1956). In French.

It is shown that the previously reported green luminescence of naphthalene crystals at low temperatures is a function of the crystal surface conditions (see Abstr. 5009/1956). G.F.J.Garlick

535.375.54/.55

7312. RAMAN SPECTRA OF SOME SIMPLE AND COMPLEX HALIDES OF CADMIUM. J.R Saraf.
Sci. of Light (Tokyo), Vol. 4, No. 1, 72-7 (Aug., 1955).

Raman spectra of aq. solutions of $CdCl_2$, KCl. $CdCl_2$, 2 KCl, $CdCl_2$, $CdBr_2$, KBr. $CdBr_2$, have been photographed with negative results. A solution of 2 KBr.$CdBr_2$, however, shows a Raman line, attributable to the $CdBr_4^{--}$ ion. A solution of CdI_2 yields a Raman line the intensity of which increased, without change in frequency, on the addition 1 and 2 mols of KI.CdI_2. Crystalline CuI_2 also shows a weak line with almost the same shift. The results show that CdI_4^{--} ions exist not only in 2 KI.CdI_2 solution, but even in pure CdI_2 both crystalline and in solution. The various physicochemical data for CdI_2 solution also point to the same conclusion. A.

535.375.54 : 537.312.62

AN ATTEMPT TO DETECT RAMAN SCATTERING OF LIGHT BY A SUPERCONDUCTOR. See Abstr. 6654

535.375.55

7313. RAMAN SPECTRA OF SOLUTIONS OF O-DICHLOROBENZENE IN METHYLCYCLOHEXANE. D.C.Biswas.
Indian J. Phys., Vol. 29, No. 11, 558-9 (Nov., 1955).

Measurements on 20% and 40% solutions of o-dichlorobenzene support the suggestion (Abstr. 8638/1955) that the Raman lines at 469 cm^{-1} and 487 cm^{-1} are due to the dimer and monomer respectively. The results suggest that in the liquid state at room temperature nearly 50% of the molecules are in the associated state. G.I.W.Llewelyn

535.375.55

7314. RAMAN SPECTRA OF IODIC ACID AT DIFFERENT DILUTIONS. J.R.Saraf.
Sci. of Light (Tokyo), Vol. 4, No. 1, 78-84 (Aug., 1955).

Physico-chemical properties of aq. solutions of iodic acid have shown breaks in the curves at 0.09N and 0.44N, which have been interpreted as transition points in the depolymerization of (HIO_3) molecules. Raman spectral evidence on this problem was obtained. A.

535.376

7315. OBSERVATIONS OF ELECTROLUMINESCENCE EXCITED BY A.C. AND D.C. FIELDS IN SURFACE-TREATED PHOSPHORS. J.N.Bowtell and H.C.Bate.
Proc. Inst. Radio Engrs, Vol. 44, No. 5, 697 (May, 1956).

Electroluminescence is produced in compacted layers of sulphides, silicates, borates and phosphates between two conducting surfaces. In d.c. the light is produced at the positive pole only. It is essential that the powder should be previously coated with an ionizable salt, e.g. potassium silicate. S.T.Henderson

535.393.08

7316. ON THE MODULATION REFLECTOMETRY OF MOLTEN METALS. A.M.Samarin and D.Ya.Svet.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 79-81 (1956). In Russian.

Describes a method of measuring the reflection coefficients ρ_R for red ($\lambda \cong 0.65\mu$) and ρ_B for blue light ($\lambda \cong 0.45\mu$) using a modulated beam of light, photocell, amplifier and an oscilloscope recorder. Values obtained were: mercury (18° C) $\rho_R = 0.76, \rho_B = 0.75$; silver (1100-1200° C) $\rho_R = 0.88$-0.98, $\rho_B = 0.84$-0.96; iron (1350-1450° C) $\rho_R = 0.59$-0.67, $\rho_B = 0.52$-0.59. J.M.Hough

535.417 : 531.717 : 535.323

7317. RECENT ATTEMPTS TO DETERMINE THE THICKNESS AND REFRACTIVE INDEX OF UNIMOLECULAR FILMS. R.D.Mattuck.
J. Opt. Soc. Amer., Vol. 46, No. 8, 615-20 (Aug., 1956).

The Hartman method for measuring the thickness and refractive index of nonabsorbing unimolecular films is investigated. Both theoretical and experimental evidence lead to unfavourable conclusions. A test experiment is reported in which the Hartman method is used to measure the optical constants of barium stearate multilayers from 50 A to 250 A in thickness. The results obtained disagree with the relatively wellknown properties of barium stearate films. To determine the cause of the disagreement, the method is investigated theoretically. It is shown by numerical calculation and algebraic analysis that, in terms of the present accuracy of the optical measurements involved, the Hartman method is too insensitive to be of practical use for films of molecular thickness. A.

535.417 : 531.717 : 535.323

7318. STEPPED INTERFERENCE REFLECTOR FOR DETERMINING THE OPTICAL CONSTANTS OF NONABSORBING UNIMOLECULAR FILMS. I. THEORY. R.D.Mattuck.
J. Opt. Soc. Amer., Vol. 46, No. 8, 621-8 (Aug., 1956).

An interference reflector consisting of two barium stearate steps (~ 1000 A and 2000 A in height) on chromium, has been devised as the basis of a simple method for the simultaneous determination of refractive index (n_2) and thickness (d_2) of nonabsorbing unimolecular films. The measured variables are the two interference fringe displacements produced when an unknown film is cast simultaneously over both steps. From these fringe shifts, n_2 and d_2 may be calculated easily by the use of approximations good to three significant figures. The method is sensitive enough to determine n_2 to within 1% and d_2 to within 4% for films ≥ 20 A in thickness. Measurements and computations for an unknown film may be completed in under 2 hr. Experimental verification is in a separate paper. A.

535.417

7319. SEMIREFLECTING SILVER FILMS FOR INFRARED INTERFEROMETRY. U.Oppenheim.
J. Opt. Soc. Amer., Vol. 46, No. 8, 628-33 (Aug., 1956).

Several important uses have now been found for the Fabry-

erot interferometer in the near infrared. It has therefore become necessary to make a search for suitable semireflectors in this region, and silver has been found to be most suitable. The optical properties of silver films have been measured for the 1 - 4 micron region. These properties have been interpreted in terms of the physical structure of the films. A.

535.42 : 534.321.9

7320. ON THE BRAGG REFLECTION OF LIGHT BY ULTRASONIC WAVES. E.H.Wagner.
Acustica, Vol. 6, No. 1, 17-24 (1956). In German.

When parallel light is reflected by ultrasonic waves, selective diffraction phenomena can occur at the Bragg angles of incidence, provided fairly high orders and depths of sound field are examined. The corresponding relationships are given and the intensity of the Bragg reflection calculated. Willard's experiments support the results obtained, but his criteria for the appearance of Bragg reflections must be modified for second and higher orders diffractions. A.

535.43 : 541.182

7321. PARTICLE SIZE DISTRIBUTIONS FROM ANGULAR VARIATION OF INTENSITY OF FORWARD-SCATTERED LIGHT AT VERY SMALL ANGLES. J.H.Chin, C.M.Sliepcevich and M.Tribus.
J. phys. Chem., Vol. 59, No. 9, 841-4 (Sept., 1955).

A mathematical basis of a method of determination of the size distribution in polydispersions based on the angular variation of the intensity of forward-scattered light is presented. An integral formula was first derived from the modified Bouguer—Beer light transmission equation to enable the computation of the size distributions of particles, large in comparison with the wavelength of the incident light, from transmission measurements at various values of the forward-scattering half angle. The accuracy of the derived integral formula was checked graphically against typical distribution curves with good results. Three possible experimental techniques of applying the integral formula are discussed, a lens-pinhole, a moving pinhole and a micro-densitometric method. In the latter two, the integral formula was modified so that the relative size distribution could be computed from measurements of the angular variation of the intensity of the forward-scattered light within a half angle of about three to four degrees. A.

535.43 : 541.182

7322. DETERMINATION OF PARTICLE SIZE DISTRIBUTIONS IN POLYDISPERSED SYSTEMS BY MEANS OF MEASUREMENTS OF ANGULAR VARIATION OF INTENSITY OF FORWARD-SCATTERED LIGHT AT VERY SMALL ANGLES. J.H.Chin, C.M.Sliepcevich and M.Tribus.
J. phys. Chem., Vol. 59, No. 9, 845-8 (Sept., 1955).

An experimental technique is described. The apparatus consists of a monochromatic, parallel light source, a dispersion cell, a lens-moving-pinhole receiving unit and a photomultiplier-potentiometer measuring system. An example of an analysis of a polydispersion of glass spheres in water is given. Close agreement was obtained between the distributions obtained by the experimental technique and the distributions obtained by microscopic counting. A.

535.43

7323. NUMERICAL SOLUTION OF PROBLEMS IN MULTIPLE SCATTERING OF ELECTROMAGNETIC RADIATION. C.M.Chu and S.W.Churchill.
J. phys. Chem., Vol. 59, No. 9, 855-63 (Sept., 1955).

The steady-state scattering and absorption of electromagnetic radiation by dispersions of particles is investigated theoretically. The results should also have applicability in describing the behaviour of thermal neutrons in dense material. Particular attention is given to dispersions of finite thickness and to anisotropic distribution of scattered characteristic of wavelengths less than the circumference of the particles. The objective was to find methods of solution suitable for numerical calculations. Existing analytical solutions of problems in multiple-scattering were found to be limited to isotropic scattering and/or dispersions of infinite extent. Approximate and numerical methods of solution proposed by previous investigators are evaluated with respect to accuracy and usability. A six-flux model is developed which reduces the general transport equation to a set of simple differential equations. Solutions suitable for numerical calculation can be obtained for most geometrical configurations of source and dispersion. An analytical solution is presented for an obliquely incident wave and a parallel-plane dispersion of finite thickness. Extension of the results to point and plane sources outside a dispersion is outlined. Degeneration of the six-flux model into a very simple two-flux model is also considered. The transmission through representative dispersions was calculated using the six-flux model, the simple two-flux model, and the diffusion equation, and the results are compared graphically. A.

535.435

7324. ON THE OPTICAL ANISOTROPY OF WATER IN SOLUTIONS OF ISOTROPIC IONS. R.Lochet, A.Rousset and J.Tourte.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2820-1 (June 11, 1956). In French.

The depolarized component of Rayleigh scattered light by dilute aqueous solutions of chlorides of K, Na, Li, Ca and Al is considerably greater than that scattered by water. This is explained by the small positive metal ions breaking up the liquid crystals of H_2O. G.F.Lothian

535.435

7325. A CENTRIFUGAL LIGHT SCATTERING CELL FOR THE ULTRACLARIFICATION OF LIQUIDS. W.B.Dandliker and J.Kraut.
J. Amer. Chem. Soc., Vol. 78, No. 11, 2380-4 (June 5, 1956).

A glass light scattering cell capable of being centrifuged at high speeds (centrifugal cell) is described. The use of this cell makes it possible to clarify liquids to a very high degree and then, without transfer, to make scattering measurements upon them. In addition, the cell has a small volume (6 ml.) and exhibits extremely low stray light down to 26° from the incident beam. It is found that this method of clarifying liquids is superior to all other methods tried, such as high speed centrifugation followed by transfer to a light scattering cell, filtration through plastic filters or filtration through ultrafine sintered glass. A.

535.515 : 548.0

7326. THE BIREFRINGENCE PATTERNS OF CRYSTAL SPHERES. C.V.Raman.
Proc. Indian Acad. Sci. A, Vol. 43, No. 1, 1-3 (Jan., 1956).

Light from an extended source traversing a sphere reaches foci lying on a concentric spherical surface of a larger radius determined by the refractive index. Hence, if the incident light be polarized and the sphere is viewed through an analyser, the interferences arising from the birefringence of the material are focused by the sphere itself on such concentric surface and rotate with the sphere when the latter is rotated. Six pages of photographs of such patterns in typical cases are reproduced. A.

535.523 : 537.226.2 : 539.11

7327. ON THE THEORY OF THE TEMPERATURE DEPENDENCE OF THE REFRACTIVE INDEX OF HOMOPOLAR CRYSTALS. E.Antončík.
Czech. J. Phys., Vol. 6, No. 3, 209-16 (1956).

The temperature dependence of the refractive index and the dielectric constant of homopolar semiconductors with a diamond structure was derived within the framework of the Kramers—Heisenberg theory. The temperature dependence of the dispersion frequencies was determined by a method analogous to the procedure in the investigation of the temperature dependence of absorption curves. It is shown that this procedure permits a satisfactory interpretation of present-day experimental knowledge for diamond, silicon and germanium. A.

535.524

7328. A SIMPLE EXPERIMENT FOR THE DETERMINATION OF THE VIBRATION DIRECTION OF THE EXTRAORDINARY RAY IN TOURMALINE. K.Gentil.
Optik, Vol. 13, No. 7, 314-16 (1956). In German.

If a tourmaline crystal is examined in natural light and rotated about an axis parallel to the optic axis there is little change in transmitted intensity. If rotated about an axis perpendicular to the optic axis a very marked intensity change is noted. The same effect occurs if the crystal is held in the diagonal position between crossed polarizer and analyser. This phenomenon enables the optic axis to be found. The effect is explained simply and also with the aid of an indicatrix.
H.G.Jerrard

535.557

7329. THE DEFORMATION OF MACRO-MOLECULES BY FLOW AND ITS INFLUENCE ON THE SIGN OF THE DYNAMICAL DOUBLE REFRACTION OF POLYMER SOLUTIONS. E.V.Frisman and V.N.Tsvetkov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 1, 42-5 (1956). In Russian.

The authors consider the molecules of a dissolved polymer to exist in the form of ellipsoids, whose shape may be altered when the solution flows. It is then assumed that the birefringence during flow is determined by both the internal anisotropy and by anisotropy of shape. An expression for the "dynamic refraction" constant, n/η, is given containing a term, n_e, relating to true anisotropy, and a term, n_f, relating to shape-anisotropy. Here η is the coefficient of viscosity of the solution, and $n = (\Delta n/gc\eta_0)\, c \to 0,\ g \to 0$, where Δn = birefringence, c = concentration in gm/cm^3, and η_0 = coefficient of viscosity of the solution. To test their hypothesis, the authors have measured Δn for solutions of polystyrene of different molecular weight ($M \cong 3 \times 10^6$, $\cong 8 \times 10^6$) in dioxan (diethylene dioxide) for different concentrations (c = 0.3 - 2.0 g/100 cm^3, and C = 0.04 - 0.20 g/100 cm^3 respectively) at different rates of flow. For these cases n_e is always negative but n_f is positive. For the first set of solutions ($M \cong 3 \times 10^6$) the birefringence was found to be negative and proportional to the flow velocity. For the second set of solutions ($M \cong 8 \times 10^6$) Δn is positive for smaller velocities and goes through a maximum to become negative with increasing velocity. Since n_e in independent of flow, it is concluded that a "shape effect" of the kind supposed exists, and that it depends on the molecular weight of the solute polymer.
H.H.Hopkins

535.56

7330. ON THE PHENOMENOLOGICAL THEORY OF LIGHT PROPAGATION IN OPTICALLY ACTIVE CRYSTALS. S.Pancharatnam.
Proc. Indian Acad. Sci. A, Vol. 43, No. 4, 247-53 (April, 1956).

In the usual treatment of the optical activity of crystals, the displacement vector of the light wave is expressed as a function of the electric vector — this being done with the aid of the dielectric tensor and the gyration-vector. The treatment is made more concise and tractable by using the inverse vector function and expressing the electric vector in terms of the displacement vector, since it is the latter which necessarily lies on the wave-front; this can be done by using the inverse of the dielectric tensor (which defines the index ellipsoid), and an inverse gyration-vector (which determines the rotatory power for the particular direction of propagation considered). The inverse gyration-vector (like the gyration-vector) is itself a function of the direction of propagation, being related to it by a modified gyration tensor — which consequently determines the rotary power for all directions. A.

535.56 : 538.613

7331. MAGNETIC ROTARY POWER AND ROTATIVITY OF SULPHUROUS ANHYDRIDE. R.de Mallemann and J.Grange.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3024-6 (June 25, 1956). In French.

Values of the Verdet constant and the specific and molecular rotations are given for gaseous and liquid SO_2 at different temperatures and pressures. For saturated and non-saturated vapour the specific and molecular rotations are constant i.e. independent of the pressure and temperature. The values of the specific rotation are about 3×10^{-6} radians and 2.85×10^{-6} radians for the non-saturated and saturated vapour respectively. The Verdet constant is a linear function of density. For liquids the specific rotation decreases slightly as the temperature rises. The rotativity of the liquid is practically equal to the molecular rotation of the saturated vapour and less than that of the unsaturated vapour. In general the rotativities of liquids are less than those for gases. H.G.Jerrard

535.563 : 538.614

7332. MAGNETIC ROTATORY POWER OF SOME DERIVATIVES OF SILICON. D.Voigt.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2929-31 (June 18, 1956). In French.

The magneto-optical constants of several silicomethanes and chlorosilanes have been determined. Results are tabulated and briefly discussed. G.I.W.Llewelyn

535.617 : 531.7

7333. MEASUREMENT OF PHYSICAL QUANTITIES BY MEANS OF COLOURS. H.Wolter.
Ann. Phys. (Leipzig), Vol. 17, No. 6-8, 329-43 (1956). In German.

In a three-dimensional system of colour specification, such as that described previously (Abstr. 997, 1951), linear independence of the basic functions is necessary but not sufficient. The author derives the necessary and sufficient condition which must be satisfied by the basic functions. These need not be known explicitly. The accuracy of the measurements made by means of the system increases with the area of the triangle formed by the three points representing the standard colours. J.W.T.Walsh

535.683.1

7334. APPARATUS FOR MEASURING THE AGEING AND FADING PRODUCED BY LIGHT. P.Schulz and K.F.Stubert.
Lichttechnik, Vol. 8, No. 6, 254-7 (June, 1956). In German.

Samples to be tested for fastness to light are mounted inside a box containing also four Xe discharge lamps each giving 4500 lm. The illumination of the samples is about 1900 lux. The temperature and humidity inside the box are carefully controlled and the fastness to light is measured on a scale of eight, the test samples being compared with a series of 8 samples of dyed wool, of progressively increasing fastness, exposed side by side with the test samples.
J.W.T.Walsh

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.8 : 537.533.3

7335. THE LIGHT GATHERING POWER OF OPTICAL SYSTEMS WITH AN ELECTRON OPTICAL MEMBER. A.Vaško.
Czech. J. Phys., Vol. 6, No. 1, 13-21 (Jan., 1956). In Russian.

The paper recapitulates the definitions of light-gathering power of purely optical systems for the case of the imaging of point and plane sources. A description is then given of the electron optical member and an attempt is made to formulate the light-gathering power of the combined systems containing this member. The light-gathering power of a system composed of an optical objective and an electron optical member for the imaging of point and plane sources is then investigated. It is shown that with such a compound optical system it is possible to achieve an increase in the brightness of the image as against that of the object. An investigation is also made into

ne light-gathering power of electron optical instruments which re composed of an optical objective, an electron optical mem- er and an optical microscope, and an expression is derived or the upper limit of the light-gathering power of this system. A.

HEAT 536

536.2.083 : 550.362

THE MEASUREMENT OF THE THERMAL CONDUCTIVITIES OF ROCKS BY OBSERVATIONS IN BOREHOLES. See Abstr. 7034

536.21

7336. THE BAR PROBLEM IN A PERIODIC SYSTEM WHEN THE PHYSICAL PROPERTIES DEPEND ON THE TEMPERATURE. P.Vernotte.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2808-10 (June 11, 1956). In French.

The equation for thermal conduction in a bar is no longer linear if the physical properties are temperature-dependent. If the relevant properties are supposed to be linearly temperature-dependent, with small coefficients, the solution of the equation by successive approximations is discussed for an impressed harmonic thermal flux. F.E.Hoare

536.21

7337. THE BAR PROBLEM IN ANY PERIODIC SYSTEM, THE PHYSICAL PROPERTIES DEPENDING ON THE TEMPERATURE. P.Vernotte.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2913-15 (June 18, 1956). In French.

See preceding abstract. The general case of a periodic, non-sinusoidal, heat influx is now considered and the conclusion reached that for practical applications it is better to work with an harmonic heat influx. The determination of thermal conductivity using harmonic heating at high temperatures when the surroundings vary in temperature is also discussed. F.E.Hoare

536.21 : 681.142

7338. THE SOLUTION OF NON-LINEAR HEAT-CONDUCTION PROBLEMS ON THE PILOT ACE. E.L.Albasiny.
Proc. Instn Elect. Engrs, Paper No. 2033 M, publ. March, 1956 (Part B Suppl. No. 1, 158-62, 163-4).

Republication, with discussion, of the paper abstracted in Abstr. 3669 (1956).

536.21 : 537.311.33

THE THERMAL CONDUCTIVITY OF SEMICONDUCTORS. See Abstr. 6628

536.21 : 537.32 : 548.52

THERMAL CONDUCTIVITY OF SINGLE CRYSTAL Bi_2Te_3. See Abstr. 7010

536.21.08

7339. THERMAL CONDUCTIVITY OF SOIL. J.Webb.
Nature (London), Vol. 177, 989 (May 26, 1956).

Gemant (Abstr. 7184/1950) has calculated the thermal resistivity of soil and the present note is a modification of his method. The result obtained is 0.0025 $cal.cm^{-1} sec^{-1} deg\ C^{-1}$ against a measured value of 0.0008 (Heat Transfer, Jakob. Wiley). The discrepancy is probably due to the assumption that the soil particles are ideally packed spheres and to the neglect of the part played by radiation and convection in the air phase. E.H.Dock

536.212.3.08

7340. CONTRIBUTION TO THE PROBLEM OF EMPLOYING THE METHOD OF AN "INSTANTANEOUS" SOURCE OF HEAT FOR THE MEASUREMENT OF THERMAL PROPERTIES OF THERMAL INSULATORS. M.A.Kaganov.
Zh. tekh. Fiz., Vol. 26, No. 3, 674-7 (1956). In Russian.

If a heat pulse is propagated through continuous matter in one dimension, a point at the distance x from the source reaches a maximum of temperature at the time $t = x^2/2\alpha$ where α is the thermal conductivity. If the time necessary for generating the heat pulse is t', a correction has to be applied which, according to the author, is of the form

$$\alpha = (x^2/2t)[1 + (t'/2t) + (5/12)(t'/t)^2 + \ldots\ldots]$$

A similar correction is calculated for an arrangement used for measuring thermal conductivities of solid materials of low thermal conductivity, in which the material is given in the form of thin discs to be fitted between the heat source and a solid of standard properties. R.Eisenschitz

536.24 : 532.51

7341. THERMAL FLUX PRODUCED BY PULSATING MOTION OF A FLUID. A.Oudart.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3038-9 (June 25, 1956). In French.

Formulae relating to the dissipation of energy and the thermal flux at the boundary walls, produced in a viscous, incompressible fluid, contained between two plane walls, and subjected to a pulsating pressure-gradient parallel to the walls, are stated. The analytical solution of the fluid motion is referred to in an unpublished report submitted to Mémoires de l'Office National d'Etudes et de Recherches Aéronautiques (Oct., 1952 and Feb., 1954). Heat-transfer at the walls becomes important at high frequencies of pulsation of the flow. The distance between the two plane boundaries has no more effect upon the boundary thermal flux than upon the mean temperature in the plane of symmetry of the flow. J.S.G.Thomas

536.24

7342. CONTRIBUTION TO THE STUDY OF HEAT EXCHANGE BETWEEN THE SOIL AND WALLS IN THERMAL INSTALLATIONS AND DWELLINGS DURING TRANSITORY STATES. P.Destable.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3047-50 (June 25, 1956). In French.

Starting from Fourier's equation an expression is deduced for the temperature distribution throughout the space concerned. E.H.Dock

536.24

7343. CONTRIBUTION TO THE STUDY OF THE TEMPERATURE DISTRIBUTION AND HEAT LOSS IN THE SOIL UNDER STEADY CONDITIONS. P.Destable.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 28-30 (July 2, 1956). In French.

It is shown that a simplification leads to the possibility of defining temperature distribution and heat flux in the sample thickness in terms of the temperatures at the four corners of the rectangular base. E.H.Dock

536.24

7344. HEAT TRANSFER FROM A ROTATING DISK.
E.C.Cobb and O.A.Saunders.
Proc. Roy. Soc. A, Vol. 236, No. 1206, 343-51 (Aug. 2, 1956).

The flow due to a disk rotating in its own plane has been investigated theoretically by von Kármán, Goldstein and others, but little has been published on the heat transfer. For laminar conditions theoretical solutions have been given by Millsaps and Pohlhausen and by Wagner, but for conditions when the flow is turbulent over the outer part of the disk there is no previous information. The present paper describes an experimental investigation of the heat transfer for a range of conditions from entirely laminar flow to conditions when the outer 80% of the disk area is under turbulence. For laminar

flow the heat transfer agrees with Wagner's results, but Millsap's theory is found to give too low values and an explanation is given. For the turbulent case, which occurs in most practical applications, values are given for the heat transfer which is found to approach the expression $N = 0.015R^{0.8}$ for all-turbulent flow. An attempt is made to deduce the turbulent flow heat transfer theoretically by assuming a $\frac{1}{7}$ power law of temperature distribution, but this gives too low a value. Some measurements of the velocity and temperature profiles both for laminar and for turbulent conditions are given. For laminar flow these show fair agreement with the theoretical values. For turbulent flow the temperature ratios are higher than those of velocity, which explains the low heat transfer values calculated assuming a $\frac{1}{7}$ power temperature distribution. The relation between heat transfer and friction torque is also discussed. A.

536.25

7345. ON THE QUESTION OF THERMOELECTRIC CONVECTION. A.G.Ostroumov and G.A.Ostroumov.
Zh. tekh. Fiz., Vol. 26, No. 3, 636-9 (1956). In Russian.

Experiments to show the existence of thermoelectric convection analogous to the thermomagnetic convection of Ageĭkin (Dokl. Akad. Nauk SSSR, Vol. 74, No. 2, 229. 1950) are described. J.M.Hough

536.33 : 538.56 : 535.11 : 534.23

RADIATION FROM A SPHERE IN THE PRESENCE OF SELF-ABSORPTION. See Abstr. 6455

536.46 : 541.126

7346. THE THEORY OF FLAME PHENOMENA WITH A CHAIN REACTION. D.B.Spalding.
Phil. Trans. A, Vol. 248, No. 957, 1-25 (1956).

For single-step reactions there is a unique relation between reaction rate and reactedness for a given combustible mixture at a specified pressure and initial temperature. This paper examines whether the relation is still unique when chain reactions are present, by considering three types of flame — spontaneous ignition, laminar-flame propagation, and the homogeneous steady-flow reaction zone — with a chain-reaction scheme proposed by Adams and Stocks for the decomposition of hydrazine. It is found that the relation is not unique but that similarities exist between the relation for laminar-flame propagation and the relation for the homogeneous reaction zone. Incidentally, a general method of calculating laminar-flame speeds with reaction schemes of arbitrary complexity is presented. When applied to the hydrazine decomposition flame the predictions of the theory are in fair agreement with experimental results. In particular, the variation of flame speed with temperature is correctly predicted. It is shown that the use of the Kármán–Penner "steady-state assumption" would lead to an overestimate of the flame speed. Consideration of the changes which would result if the chain reaction should branch shows that there would once again tend to be a unique reaction rate versus reactedness relation and that the laminar-flame speed would be increased by a factor of about three for the hottest flame considered but by larger factors for cooler flames. A.

536.461

7347. CRITICAL CONSIDERATIONS IN THE MEASUREMENT OF BURNING VELOCITIES OF BUNSEN BURNER FLAMES AND INTERPRETATION OF THE PRESSURE EFFECT. MEASUREMENTS AND CALCULATIONS FOR METHANE. W.H.Clingman and R.N.Pease.
J. Amer. Chem. Soc., Vol. 78, No. 9, 1775-80 (May 5, 1956).

In order to elucidate such questions as the mechanism of propagation and general nature of the chemical reactions for hydrocarbon flames, an investigation has been conducted of the burning velocity of methane under various conditions. The experimental results have been compared with the Semenov and a modified form of the Tanford–Pease theory of flame propagation. An improved Bunsen burner method of determining the burning velocity has been presented in which it is determined for each flame observed whether there is a region of the flame cone over which the flame velocity is constant. Values for the burning velocity are assigned to the mixture only in those cases where such a constant region is found. The method has been shown to give burning velocity values which are independent of flow rate and burner diameter. The burning burning velocity of stoichiometric mixtures of methane in nitrogen–air at sub-atmospheric pressures has been found to vary as the -0.25 power of the pressure near one atmosphere and as the -0.5 power near one-half atmosphere. The pressure exponent of stoichiometric methane, helium–air mixtures was found to be -0.2. These results could not be accounted for with the Semenov equation for a bimolecular reaction, which predicts a decrease in burning velocity rather than an increase with decreasing pressure. If a thermal theory is to explain the results, it is necessary to postulate the existence of an important first-order reaction in the combustion zone. On the other hand, the Tanford–Pease theory does predict the observed effect qualitatively, though not quantitatively. Burning velocities of methane in nitrogen, argon and helium "airs" were redetermined by the improved method with some modification of earlier results. A.

536.461

7348. A COMPARISON OF THE BURNING VELOCITIES OF METHANE AND HEAVY METHANE IN NITROGEN AND ARGON "AIRS" AT ATMOSPHERIC PRESSURE.
W.H.Clingman and R.N.Pease.
J. Amer. Chem. Soc., Vol. 78, No. 12, 2695-8 (June 20, 1956).

In order to determine whether diffusion or heat conduction is more important in flame propagation, the burning velocities of methane (CH_4) and heavy methane (CD_4) were measured at atmospheric pressure and in both nitrogen and argon "airs". The Semenov bimolecular equation, based on a thermal theory of flame propagation, predicted a much greater increase in the burning velocity than was observed on going from nitrogen-air to argon-air. The ratio of the burning velocity of a mixture with CH_4 to that of a mixture with CD_4 of the same composition was always greater than one and increased with increasing concentration of fuel. This behaviour is in qualitative agreement with a diffusion mechanism. It is shown that a thermal theory does not account for this increase in the burning velocity ratio if it is assumed that changes in the thermal properties of the system such as thermal conductivity, flame temperature and heat capacity can be neglected upon replacing CH_4 with CD_4. A.

536.48

7349. ELEMENTARY THEORY OF THE EXCITATIONS IN LIQUID HELIUM: NEW MODEL FOR ROTONS. O.K.Rice.
Phys. Rev., Vol. 102, No. 5, 1416 (June 1, 1956).

Rotons are visualized as rotating pairs of atoms; the rotation is hindered by potential barriers and two pairs of molecules may interact dynamically. Using this model it is attempted to obtain estimates regarding the lowest energy levels and their degeneracies of rotons in liquid He^4 and He^3. R.Eisenschitz

536.48

7350. THE BEHAVIOR OF HELIUM II IN THE NEIGHBORHOOD OF A HEAT RADIATING SURFACE.
É.L.Andronikashvili and G.G.Mirskaya.
Zh. éksper. teor. Fiz., Vol. 29, No. 4(10), 490-4 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 406-9 (May, 1956).

Investigations have been made on the magnitudes of temperature discontinuities arising in the surface layer of He II in contact with a solid wall that is supplied with heat. A.

536.48

351. TRANSFORMATION OF THE λ-TRANSITION IN ELIUM INTO A SPECIAL KIND OF FIRST-ORDER TRANSI-ION IN PRESENCE OF A FLOW OF HEAT. V.P.Peshkov. h. éksper. teor. Fiz, Vol. 30, No. 3, 581-2 (1956). In ussian.

Liquid He^4 is held in a container two sides of which consist of (inclined) plates of optical glass. A gradient of temperature is set up with extreme temperatures below and above he λ-point. Interference fringes are observed; photographs re shown in the published paper. It is found that the interface etween helium I and helium II shows as an abrupt, virtually scontinuous, change in the interference pattern. It follows hat the density changes "discontinuously" at the interface. he difference in density between the two phases is proporonal to the square of the flow of heat across the unit of area. he author concludes that the "discontinuity" in density is ccompanied by a "discontinuity" in temperature and, possibly, ven in pressure. This result is described as a transition of he first-order into which the ordinary second-order transion is transformed by the presence of flowing heat.

R.Eisenschitz

536.48

7352. PROPAGATION OF SOUND IN FLOWING HELIUM II AND THE EFFECT OF HEAT FLOW ON THE PROPAGATION OF SECOND SOUND. I.M.Khalatnikov.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 617-19 (1956). In Russian.

In ordinary liquids the propagation of sound is affected by a "drag" due to flow. In the present note the corresponding phenomenon in superfluids is analysed from the point of view of the two-fluid model. Starting from the set of the appropriate hydrodynamical equations a quantitative deduction of the velocity of sound is carried out. Results for the first sound correspond to the ordinary hydrodynamics. The velocity of second sound involves a term which is proportional to the velocity of the normal component in direction of the wave vector. The factor of proportionality can be evaluated interms of the thermodynamical properties of the two-fluid model. This factor appears to depend sensitively upon the temperature and is negative between 0.5 and 0.8°K. According to the properties of the two-fluid model the velocity of second sound in presence of heat flow depends on the value of the heat flow since this is proportional to the velocity of the normal component. R.Eisenschitz

536.48 : 536.423

7353. DIAGRAM OF STATE FOR LIQUID-VAPOUR SYSTEM OF HELIUM ISOTOPES He^3—He^4. I. B.N.Esel'son and N.G.Bereznyak.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 628-39 (1956). In Russian.

The vapour pressure temperature-dependence of twenty solutions of helium isotopes containing from 0.4% to 90.8% of He^3 and also the pressure corresponding to the initiation of condensation in eight mixtures of helium isotopes containing from 1.9 to 82.4% of He^3 have been measured. The state diagram of the liquid-vapour system of He^3—He^4 has been constructed and the dependence of the partition of He^3 between the liquid and the vapour state on the temperature and concentration of the liquid phase has been determined. A.

536.48 : 530.145

7354. REMARKS ON QUANTUM HYDRODYNAMICS. H.Itô.
Progr. theor. Phys., Vol. 13, No. 5, 543-54 (May, 1955).

In the perturbation method which is called "sound approximation" in quantum hydrodynamics, the invariancy of each same-order term in the Hamiltonian is studied in detail by the gauge transformation. For a special case, where the fluid is nonviscous and incompressible, the eigenvalue problem of the Hamiltonian which includes only the rotational part of the fluid velocity is calculated. The energy spectrum of the lowest state of the roton is given by Ziman's method for this special case. The expression of the energy spectrum of the roton does not diverge or contain any additional constant term while Ziman's result does. The difference between these two results is discussed. A.

536.5

7355. ON THE STATIONARY TEMPERATURE FIELD IN A THIN PLATE OR ROD RESTING ON A CONTINUOUS HOMOGENEOUS FOUNDATION. B.G.Korenev.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 2, 225-8 (1956). In Russian.

The author uses results previously derived by him for plates on an elastic foundation to calculate temperature distributions in an infinite isotropic plate or rod resting on a homogeneous foundation, taking account of the heat transfer to the surroundings. A number of cases with various arrangements of point heat sources on the plate is solved. A.Gelbtuch

536.5 ; 533.7

7356. ON THE QUESTION OF THE EFFECTIVE TEMPERATURE OF RADIATION. V.I.Pukhov.
Zh. tekh. Fiz., Vol. 26, No. 1, 149-56 (1956). In Russian.

A mathematical discussion of the effective temperature (for radiation calculations) of the gas in the neighbourhood of a heated surface. The gas streams past the surface and the author has derived formulae for several cases. J.M.Hough

536.532 : 621.43

7357. MEASUREMENT AND RECORDING OF PISTON TEMPERATURES IN A RUNNING MOTOR. W.Oesterlin.
Arch. tech. Messen, Issue No. 239 (Ref. V 8234-16), 269-72 (Dec., 1955). In German.

A thermocouple is built into the piston and is connected to two brushes which make contact with segments fixed at the lower dead-centre position. Measurement of the thermo-e.m.f. is by a counter-e.m.f. arrangement with a galvanometer for balance indication. With high-speed engines, galvanometers are subject to vibration troubles, and a description is given of an electronic balance detector comprising a single-stage amplifier and a "magic eye", which is not distrubed by vibration. C.F.Pizzey

536.581.3 : 539.152.2 : 535.34.07

MULTIPLE TARGET NUCLEAR MAGNETIC RESONANCE CRYOSTAT. See Abstr. 6516

536.631

7358. HEAT CAPACITY OF DYSPROSIUM FROM 15 TO 300°K. M.Griffel, R.E.Skochdopole and F.H.Spedding.
J. chem. Phys., Vol. 25, No. 1, 75-9 (July, 1956).

The heat capacity of dysprosium has been measured over the range 15 to 300°K, and the thermodynamic functions have been calculated. Dysprosium had previously been found to exhibit two magnetic transitions and corresponding to these we have observed two maxima in the heat capacity, one at 174°K and a second at 83.5°K. Only the lower peak shows a dependence on the thermal history of the sample and this dependence was investigated. A correlation of the various contributions to the entropy at room temperature indicates that the magnetic contribution is $R \ln(2J + 1)$. The value of $S^0_{298.16}$ is 17.87 cal $(°K)^{-1}$ $(g\ atom)^{-1}$. A.

536.631 : 536.48

7359. ON THE INTERIONIC CONTRIBUTIONS TO THE SPECIFIC HEAT OF COBALT AMMONIUM TUTTON SALT $Co(NH_4)_2(SO_4)_2 6H_2O$ AT VERY LOW TEMPERATURES. T.Nakamura and N.Uryû.
J. Phys. Soc. Japan, Vol. 11, No. 7, 760-9 (July, 1956).

The specific heat of cobalt ammonium sulphate $Co(NH_4)_2(SO_4)_2 \cdot 6H_2O$ in the liquid helium temperature region is investigated theoretically. The possible contributions to it are the dipole—dipole and the exchange interactions between Co^{2+} ions and the hyperfine interactions within each ion. The inves-

tigation aims at obtaining the first two contributions. The dipole–dipole interactions are given by use of the anisotropic g-factors determined from the paramagnetic resonance. And the exchange interactions are determined by modifying the isotopic exchange interactions by the wave functions of the lowest Kramers doublet, where only the interactions with the first and second neighbouring ions were taken into account. The result obtained from the moment expansion method gives $C_V T^2/R = 30.2 \times 10^{-4}$ which is in good agreement with the experimental value 27×10^{-4}. Here C_V is the interionic (dipole–dipole and exchange) part of the specific heat at moderately high temperatures, T the absolute temperature and R the gas constant. A.

536.664

7360. HYDRATION ENERGY OF IONS. C.Komatsu and J.Shimokawa.
J. chem. Phys., Vol. 24, No. 6, 1253-4 (June, 1956).

A nonempirical calculation of the first- and second-order perturbation energies of the H_2O molecule in the field of the H^+ ion is reported. The hydration energy of H^+ is calculated at 274 kcal/mole, the contribution due to the entropy factor being neglected. G.Allen

THERMODYNAMICS 536.7/.8

536.7

7361. ON CERTAIN SIMPLIFYING HYPOTHESES WHICH GIVE RISE TO THE NOTION OF ENERGY CONSERVATION IN THE DOMAINS WHERE THEY ARE APPLICABLE. P.Renaud, M.Joly and D.G.Dervichian.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 24-6 (July 2, 1956). In French.

An abstract scheme supplementary to that of Abstr. 2690 (1955) explaining the intellectual operations involved in discussing coupling between "isolated" systems. R.O.Davies

536.7

7362. ON THE RELATIVE FLOW OF A FLUID. J.E.Verschaffelt.
J. Phys. Radium, Vol. 17, No. 4, 313-19 (April, 1956). In French.

It is shown how a moving observer may give a general formulation of the fundamental laws of thermomechanics of a fluid starting from those for a fixed observer. The general considerations are applied to the specific examples of a rotating liquid in a cylindrical drum and the flow in a curved tube. F.E.Hoare

536.7

7363. THE BOLTZMANN EQUATION AND IRREVERSIBLE THERMODYNAMICS. H.Kümmel.
Z. Phys., Vol. 145, No. 4, 496-503 (1956). In German.

The Boltzmann equation is simplified by a linearization which enables its characteristic properties to be perceived by inspection. In particular the description of the approach to equilibrium becomes evident and the Onsager relations can then be simply deduced. T.P.Brody

536.71 : 539.11

7364. EQUATION OF STATE OF SOLIDS. B.Dayal and C.Purushothaman.
J. chem. Phys., Vol. 24, No. 6, 1257-8 (June, 1956).

The equation combines Furth's power law with Gruneisen's theory. P-V data calculated for aluminium are compared with Bridgman's experimental results. G.Allen

536.75

7365. ON THE DIFFERENTIAL PROPERTIES OF ENTROPY PRODUCTION. II. I.Prigogine and R.Balescu.
Bull Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 9, 917-28 (1955). In French.

For Pt I, see Abstr. 1790 (1955). A differential property of the entropy production, established in Pt I, is used to study variational principles associated to stationary non-equilibrium situations when the theorem of minimum entropy production is no longer valid. The case of one and two variables is readily solved in a general way. Restrictions which exist for more than two independent variables are discussed. A.

536.75

7366. EXTENSION OF THE STATISTICAL PROOF OF THE MINIMUM ENTROPY PRODUCTION THEOREM. P.H.E.Meijer.
Phys. Rev., Vol. 103, No. 4, 839-44 (Aug. 15, 1956).

Klein and Meijer (Abstr. 268/1955) gave a proof of the minimum entropy production in the steady state based on the principles of statistical mechanics, making use of a simple model of a nonequilibrium system. In the first part of this paper it is shown how such a proof has to be modified in case particles that obey Fermi–Dirac or Bose–Einstein statistics are concerned. It is found that the constraint that the total number of particles has to be constant does not have to be made. The second part of the paper describes a different generalization, viz. to systems in which the total number of particles is variable. Both results will serve as a description for models less restrictive than that used in the paper mentioned above. A.

536.76

7367. THERMODYNAMIC RELATIONS APPLICABLE NEAR A LAMBDA-TRANSITION. A.B.Pippard.
Phil. Mag. (Ser. 8), Vol. 1, No. 5, 473-6 (May, 1956).

The purely phenomenological assumption of a kind of cylindrical regularity in thermodynamic functions along the λ-line leads to a linear relation between specific heat and expansivity near the λ-line whose slope gives the slope of the λ-line on the p-T plane. This agrees with experimental data on NH_4Cl. R.O.Davies

ELECTRICITY 537

ELECTROSTATICS. DIELECTRICS 537.2

537.213 : 621.372 : 621.317.715

7368. NETWORK THEOREMS APPLIED TO A DETERMINATION OF THE RESISTANCE AND SENSITIVITY OF A GALVANOMETER. G.C.McCormick.
Amer. J. Phys., Vol. 24, No. 5, 359-62 (May, 1956).

Deflection methods used in laboratory courses for determining the resistance and sensitivity of a galvanometer normally involve errors due to contact potentials. Considerations underlying the avoidance of such errors are reviewed. A method of measurement using Thévenin's and other network theorems is presented. Resistance and sensitivity measurements over the complete scale range are readily made to within 0.15%. A.

537.213 : 621.317.715

7369. WIDE AMPLITUDE STRING GALVANOMETER FOR DIRECT RECORDING. L.B.Browder.
Rev. sci. Instrum., Vol. 27, No. 6, 363-8 (June, 1956).

By employing an Einthoven or string galvanometer rather than the usual D'Arsonval galvanometer in a direct-writing oscillograph a considerable reduction in inertia of the moving element is obtained. The use of compliant end supports makes possible very large deflections so that a 10 cm long string having a resonant frequency of 230 c/s can be made to move

rough an amplitude of 2.5 cm. The nonlinearity associated th the large amplitude can be corrected by shaping of the agnetic field, and electromagnetic damping of the order of itical or less obtainable. A.

537.226

70. CONTRIBUTION TO THE THEORY OF POLAR RYSTALS IN AN EXTERNAL ELECTRIC FIELD.
.E.Glauberman.
kl. Akad. Nauk SSSR, Vol. 108, No. 1, 49-52 (1956). In ıssian.

A cubic lattice of freely rotating polar molecules is emoyed as a model for polar crystals. The molecules are supsed to interact by dipole-dipole forces only. The energy of teraction is supposed to be small in comparison with the ean thermal energy. The angular distribution of the moleules is, in the first approximation, determined by an external ectrostatic field. The angular distribution function and the ermodynamic functions can then be expanded in powers of a nall parameter which is proportional to the dipole moment a molecule. The thermodynamic energy and the free energy e derived up to the second power of this parameter.
R.Eisenschitz

537.226.1 : 539.133

371. INFLUENCE OF MOLECULAR ELECTRIC QUADRUOLE MOMENTS ON DIELECTRIC CONSTANTS.
.W.Zwanzig.
. chem. Phys., Vol. 25, No. 2, 211-16 (Aug., 1956).

The effect of a molecular electric quadrupole moment on ıe dielectric constant of a gas composed of nonpolar molecules s calculated to the lowest order of density and polarizability in hich it appears. The quadrupoles induce electric dipoles in eighbouring molecules, and these dipoles interact with an aplied uniform electric field. The total effect is a deviation rom the Clausius–Mosotti equation, proportional to the square f the quadrupole moment, and of the same order of magnitude s the deviation due to fluctuations in dipole moment calculated y Kirkwood, and the deviation due to the variation of polarizbility with density calculated by Mazur and Jansen. The theory s tested by calculating the quadrupole moment of CO_2 from dilectric constant data. The result is about five times larger han the value obtained by microwave pressure broadening, and s about 40% larger than the value obtained by Pople from the econd virial coefficient of CO_2. A.

537.226.1.08

372. NEW LOW DEAD CAPACITY CONDENSERS FOR MEASURING DIELECTRIC CONSTANTS OF LIQUIDS.
M.Jeżewski.
cta phys. Polon., Vol. 14, No. 6, 483-8 (1955).

A new construction of cylindrical condensers for measuring dielectric constants of liquids has been described. Several ondensers of different capacities up to 140 pF have been conıtructed. An absolute measurement of the dielectric constant f commercial, chemically pure benzene has been made, and hen by means of this benzene the dead capacities of the above nentioned condensers have been determined. It has been roved that they had a dead capacity of the order of 0.1 pF and xtremely small losses. The volume of the liquid necessary or the filling of the condenser amounted to 10-15 cm^3. A.

537.226.1.08

7273. A NEW METHOD OF MEASURING THE COMPLEX DIELECTRIC CONSTANT AT CENTIMETRE WAVELENGTHS — APPLICATION TO THE STUDY OF WATER ADSORPTION PHENOMENA. J.Le Bot.
Ann. Phys. (Paris), Ser. 13, Vol. 1, 463-92 (May-June, 1956). In French.

The rod-shaped specimen is mounted transversely, parallel to the electric field, in a rectangular waveguide and is backed either by a matched termination or by an adjustable short-circuit, the standing-wave-ratio being measured in front of the specimen. The method of calculation is given in detail, with a discussion of sources of error. Dielectric loss results obtained for water adsorbed on silica and alumina gels are shown as functions of water content and temperature, activation energies being estimated from the temperature-dependence of the frequency of maximum loss. F.F.Roberts

537.226.1.08 : 538.22.08

7374. EXTENSION OF THE "THIN-SAMPLE METHOD" FOR THE MEASUREMENT OF INITIAL COMPLEX PERMEABILITY AND PERMITTIVITY. E.E.Conrad, C.S.Porter, N.J.Doctor and P.J.Franklin.
J. appl. Phys., Vol. 27, No. 4, 346-50 (April, 1956).

A summary is given of the theory of measurement of complex relative permeability and permittivity of low conductivity materials by the thin-sample method using a slotted transmission line. The equations from which to calculate the electrical properties from the measured parameters are extended to apply to a commercial slotted line and thus to a more complex system than that used by other workers. Some errors of the measurements are discussed and various correctional equations derived by other workers are given. A.

537.226.2

7375. MEASUREMENT OF THE COMPLEX DIELECTRIC CONSTANT ON SOLID THIACYCLOHEXANE. L.Reinisch.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2915-18 (June 18, 1956). In French.

The complex permittivity of $C_5H_{10}S$ has been measured over the frequency range 80 c/s-400 kc/s and over the temperature range -180°C to -20°C. Sharp rises in ϵ' and sharp peaks in ϵ'' were found throughout the frequency range at -67°C and -30°C. From an analysis of Cole–Cole plots it is concluded that two relaxation processes are present, with activation energies of 18 and about 2 kcal/mole respectively. A comparison with the results of Waddington et al. (J. Amer. Chem. Soc., Vol. 76, No. 10, 2661, 1954) is given.
F.F.Roberts

537.226.2

7376. DIELECTRIC PROPERTIES OF AMMONIUM IODIDE. K.-I.Kaniyoshi.
J. chem. Phys., Vol. 24, No. 6, 1265-6 (June, 1956).

At 2 Mc/s, the permittivity ϵ, of single crystals of NH_4I falls abruptly with decreasing temperature at -13.5 and -44°C. These values differ from previous results. X-irradiation colours NH_4I crystals dark brown and alters the ϵ–T characteristics; i.e. there is a peak at -26°C and an abrupt fall at -52°C. The coloured crystals show marked absorption at 3.3 eV; indicating that X-irradiation ionizes the NH_4 group (Abstr. 8322/1953). J.H.Mason

537.226.2

7377. FERROELECTRICITY IN AMMONIUM SULFATE. B.T.Matthias and J.P.Remeika.
Phys. Rev., Vol. 103, No. 1, 262 (July 1, 1956).

$(NH_4)_2SO_4$ is stated to be ferroelectric parallel to the a-axis at temperatures below the -49.5°C dielectric transition. At -58°C, the spontaneous polarization is 2.54×10^{-7} C/cm^2 and the coercive field 2 kV/cm. It is suggested that in this material, G.A.S.H., and the ferroelectric alums, the N–H–O bonds may make an important contribution to the ferroelectric behaviour. L.E.Cross

537.226.2

7378. ANOMALOUS POLARIZATION IN UNDILUTED CERAMIC $BaTiO_3$. H.L.Blood, S.Levine and N.H.Roberts.
J. appl. Phys., Vol. 27, No. 6, 660-1 (June, 1956).

The remanent polarization and electromechanical response of undiluted ceramic $BaTiO_3$, pre-polarized with fields of from 5 kV/cm to 30 kV/cm for several hours, has been measured over the temperature range $25^\circ C \geq T \geq 150^\circ C$. Some samples showed anomalous behaviour, changing colour

on poling and giving values of remanent polarization up to 150 μ C/cm^2, with the sign of the polarization and electromechanical response reversed with respect to the initial poling field in certain temperature ranges. It is suggested that the observed effects are due to anisotropic ordering of the tetragonal surface layer at the grain boundaries produced by changes in ionic defect concentration. L.E.Cross

537.226.2

7379. TIME CHANGES IN THIN FILMS OF $BaTiO_3$. C.Feldman.
J. appl. Phys., Vol. 27, No. 8, 870-3 (Aug., 1956).

The decrease of dielectric constant with time under an applied alternating field, less than the coercive field, has been studied in films of $BaTiO_3$ between 1 and 3 microns thick. The phenomenon may be interpreted as being associated with the process of switching the domains to a position more nearly parallel to the applied field. A.

537.226.2

7380. INVESTIGATION OF THE DEPENDENCE OF THE DIELECTRIC PERMITTIVITY AND THE TANGENT OF THE DIELECTRIC LOSS ANGLE OF BARIUM TITANATE ON THE STRENGTH OF A HIGH-FREQUENCY ELECTRIC FIELD. E.V.Sinyakov and V.V.Gal'pern.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 675-80 (1956). In Russian.

A method for measuring the dielectric permittivity and tan δ of ferroelectric ceramics in strong high-frequency fields (10^6 c/s) is described. Results of measurement at various temperatures of the electric field strength dependence of capacitance and tan δ of barium titanate are discussed. A.

537.226.2.08 : 621.3.011.5.08

7381. THE DETERMINATION OF DIELECTRIC CONSTANTS OF LIQUIDS BY USE OF A REFERENCE SUBSTANCE. I. SURVEY. II. CONSTRUCTION OF A MEASURING CELL. R.Mecke and K.Rosswog.
Arch. tech. Messen, Issue No. 235 (Ref. V 942-5), 185-8 (Aug.); Issue No. 237 (Ref. V 942-6), 229-30 (Oct., 1955). In German.

Pt I reviews the principle of measurement (comparison of capacitance) standard liquids and the various forms of measuring cell which have been used, in particular, that due to Hartshorn and Oliver. Pt II describes a cell of cylindrical form developed by the authors. Its capacitance (empty) is 13.6 pF and the volume 75-80 cm^3. Temperature curves are given for the cell with, and without, guard ring. C.F.Pizzey

537.226.3

7382. ON THE ANALYSIS OF CERTAIN DISPERSIONS OF DIPOLAR ORIENTATION. C.Brot.
J. Chim. phys., Vol. 53, No. 5, 451-2 (May, 1956). In French.

The total dielectric dispersion for a two-step process with a series decay is analysed and is shown not to be the sum of the separate relaxations, as is true for parallel decay. There is qualitative agreement with the dispersion of some alcohols where the successive states may be those of the dipoles at the middle and the end of the polymer chains. D.H.Whiffen

537.226.31

7383. DIELECTRIC ABSORPTION IN LITHIUM FLUORIDE. J.S.Dryden and D.A.A.S.Narayana Rao.
J. chem. Phys., Vol. 25, No. 2, 222-4 (Aug., 1956).

The dielectric loss in single crystals of lithium fluoride has been examined between temperatures of 0°C and 130°C. At the lower temperatures the dielectric loss, as a function of frequency, passes through a definite maximum and is quite distinct from the background loss due to d.c. conductivity. From the experimental results, the frequency factor (7×10^{12} sec^{-1}) and energy barrier (0.65 eV) are derived. After darkening with X-rays the absorption disappears and reappears again after bleaching. A.

537.226.33

7384. EFFECT OF HYDROSTATIC PRESSURE ON THE HYSTERESIS LOOP OF GUANIDINE ALUMINUM SULFATE HEXAHYDRATE. W.J.Merz.
Phys. Rev., Vol. 103, No. 3, 565-6 (Aug. 1, 1956).

The 60 c/s hysteresis loop was measured as a function of hydrostatic pressure. It was found that the spontaneous polarization P_S and the coercive field strength E_C increase with pressure. It could be shown that to a first approximation P_S and E_C are a function of the volume change alone, regardless of whether this volume change is obtained by hydrostatic pressure or by lowering the temperature. The measurements suggest that the shortening of the polar c axis causes an increase of the dipole moment along this axis. A.

537.226.8 : 537.312.5

7385. THE PHOTODIELECTRIC EFFECT IN THE SULPHIDE AND OXIDE OF ZINC. J.Roux.
Ann. Phys. (Paris), Ser. 13, Vol. 1, 493-545 (May-June, 1956 In French.

A study is made of the variations in capacity and conductance of a condenser cell with photosensitive ZnS or ZnO as dielectric. The photodielectric effect is shown to arise from three possible processes, namely a modification of the complex dielectric constant, from the production of photoconduction (free charge carriers) or by a Maxwell—Wagner effect produced by photoconducting grains of phosphor with potential barriers between grains. It is shown experimentally that for some cases a modification of the complex dielectric constant (i.e. due to creation of dipoles in the crystal volume) can be distinguished. G.F.J.Garlick

537.226 8

7386. DIELECTRIC DISPERSION OF POLYVINYL ACETATE IN TOLUENE. W.G.Hammerle and J.G.Kirkwood.
J. chem. Phys., Vol. 24, No. 6, 1277 (June, 1956).

Results from two recent investigations are compared with Kirkwood's modified theory (Abstr. 314/1956). The average value of the maximum reduced dispersion is within 3% of the theoretical value and the theoretical curve follows the observed dispersion over the experimental frequency range. The temperature dependence of the dispersion gives $\Delta H = 2.15$ kcal/mole. The dependence of the frequency of maximum dispersion on molecular weight is at variance with theory. G.Allen

537.228 : 535.32

7387. ELECTRO-OPTICAL SHIFT. G.H.Brown, J.F.Dreyer, H.R.Lubowitz and W.H.H.Middendorf.
Experientia, Vol. 12, No. 1, 15-16 (1956).

A transverse deflection of a beam of white light on passing through a liquid dielectric (ethyl acetate, absolute alcohol, absolute methyl alcohol, secondary butyl alcohol, tertiary amyl alcohol, carbon disulphide, nitrobenzene, chloroform and p-tolyl acetate) in the presence of a strong electric field (10 000 V/cm). The effect is intensified if the electrodes are corrugated. J.M.Hough

537.228.1

7388. DETERMINATION OF A FEW ZERO-TEMPERATURE COEFFICIENT (TC) CUTS OF Y-CUT EDT (ETHYLENE DIAMINE TARTRATE) CRYSTALS FOR LONGITUDINAL MODE OF VIBRATION. M.Shaki.
Czech. J. Phys., Vol. 6, No. 3, 287-97 (June, 1956).

The zero-temperature coefficients of frequency for the longitudinal mode of vibration for Y-cut crystals are studied with respect to their w/l (width to length ratio) for different angle of cut Ψ. Zero TC cut for $\Psi = 180°$ (i.e. length along the x axis) is studied in conjunction with the coupling effect and the changing modes of vibration of the main longitudinal, first and second flexural and other strong modes. Further, the zero TC cut for $\Psi = 160°$ and $\Psi = 170°$ are studied and their corresponding w/l given. A.

537.228.1 : 534.232

NON-DIRECTIVE CERAMIC SOUND RECEIVERS. See Abstr. 6458

537.228.1.08 : 621.317.79

7389. AN INSTRUMENT FOR THE ANALYSIS OF THE PIEZOELECTRIC PROPERTIES OF CRYSTALS. M.I.Yaroslavskiĭ, R.M.Lyutenberg and V.N.Chernȳshov. Zh. tekh. Fiz., Vol. 26, No. 2, 439-41 (1956). In Russian.

A self-blocking oscillator with pulse length of 3 msec and repetition rate ≅ 8 msec has a continuously varying frequency of oscillation. The connection to the first stage of the amplifier is interrupted by two separate plates at right angles to each other. The tested crystal (quartz, ammonium phosphate or any other) is arranged to touch both plates. When the crystal is in resonance the transmitted pulse has increased length and some attenuation. The shape of the pulse gives the semiquantitative evaluation of crystal attenuation, piezomodulus, etc. The magnitude of the monocrystallic region is related to the pulse shape. M.W.Makowski

ELECTRIC CONDUCTION. CURRENTS 537.3

537.3.08 : 621.317.311

7390. CALIBRATION OF CURRENT INTEGRATORS FOR SMALL BEAM CURRENTS. H.N.Royden and D.O.Caldwell. Rev. sci. Instrum., Vol. 27, No. 2, 91-4 (Feb., 1956).

The current-time method of calibrating beam current integrators has been extended to give reliable calibrations for small currents when used with a feedback electrometer. The method described has given calibrations with absolute standard errors ranging from 0.2% at 10^{-10} amp to 0.3% at 10^{-11} amp. The equipment needed, including a precision 100-megohm resistance, is described, and some experimental difficulties in making calibrations for small currents are discussed. A.

537.311 : 538.632

7391. HALL EFFECT AND CONDUCTIVITY IN POROUS MEDIA. H.J.Juretschke, R.Landauer and J.A.Swanson. J. appl. Phys., Vol. 27, No. 7, 838-9 (July, 1956).

The effect of pores of various shapes and orientations on the usual conductivity σ_0 and Hall constant R_0 is considered. The effective values of these quantities are shown theoretically to be of the form $\sigma = f(\epsilon)\sigma_0$, $R = g(\epsilon)R_0$, where ϵ is the fraction of missing conductive material. The functions f and g are given for four different simple models for the pores.

P.T.Landsberg

537.311.1 : 539.11

7392. THE MEASUREMENT OF THE SPECIFIC CHARGE OF CONDUCTION ELECTRONS. V.M.Yuzhakov. Zh. éksper. teor. Fiz., Vol. 29, No. 3(9), 388-90 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 332-4 (March, 1956).

A possibility of measuring the ratio e/m for conduction electrons is pointed out. The method envisaged relies upon compensation of a Lorentz force by a Coriolis force.

P.T.Landsberg

537.311.1

7393. CONDUCTIVITY OF SILVER BROMIDE IN THE PRESENCE OF BROMINE. L.M.Shamovskiĭ, A.A.Dunina and M.I.Gosteva. Zh. éksper. teor. Fiz., Vol. 30, No. 4, 640-8 (1956). In Russian.

It is shown that silver bromide crystals additively coloured in bromine vapour acquire hole conductivity the magnitude of which is proportional to the square root of the halogen gas partial pressure and exponentially increases with the temperature. Even at small pressures of bromine the hole conductivity of AgBr is comparable to the ionic conductivity of these crystals. During additive colouring V_1-centres are formed which are complexes consisting of a vacant cation lattice point in which a hole is located. The thermal dissociation energy of V_1-centres in AgBr is estimated to equal 0.3 eV. Due to the absence of vacant anionic lattice points in silver bromide F-centres are not formed. Bromine atoms or molecules do not dissolve or diffuse in the AgBr lattice. A.

537.311.31 : 538.63

7394. LOW TEMPERATURE MEASUREMENTS OF THE MAGNETORESISTANCE AND THE REDUCED KOHLER DIAGRAM OF RHENIUM WIRES. G.Lautz and W.Ruppel. Z. Naturforsch., Vol. 11a, No. 5, 379-82 (May, 1956). In German.

Reports results of measurements of the resistivity of rhenium between 10° and 300°K; the resistivity is constant at 6.99×10^{-7} ohm cm up to about 20°K and then increases linearly. The resistivity change in a transverse magnetic field was measured up to 2.3×10^4 oersted, both for untreated and annealed specimens. The magnetoresistance was plotted on a reduced Kohler diagram, and differences were observed between the results for compact wires and earlier results for sintered specimens. E.P.Wohlfarth

537.311.31 : 536.212.2

CONDUCTIVITIES OF IRON, NICKEL, TITANIUM, AND ZIRCONIUM AT LOW TEMPERATURES. See Abstr. 6555

537.311.32

7395. FUNDAMENTAL FACTORS CONTROLLING ELECTRICAL RESISTIVITY IN VITREOUS TERNARY LEAD SILICATES. S.W.Strauss, D.G.Moore, W.N.Harrison and L.E.Richards. J. Res. Nat. Bur. Stand., Vol. 56, No. 3, 135-42 (March, 1956).

The resistivities of selected vitreous ternary lead silicates containing ions of groups I, II, III, IV, and also the ions chromium, manganese, iron, cobalt, and nickel were measured in the range 200° to 500°C and at an applied direct-current field of 525 V/cm. In addition, the resistivities of vitreous silica and of quartz, with optic axis parallel and perpendicular to the applied field, were measured over the same temperature range. The resulting data are given as log resistivity—composition isotherms for the alkalies and alkaline earths and as log resistivity—temperature curves for the other ions. Correlations between resistivity and bonding energy and between frequency factor and heat of activation are presented. The resistivities of the alkali lead silicates were interpreted from the standpoint of the activation energy principle. A.

537.311.32

7396. ELECTRICAL RESISTIVITY OF VITREOUS TERNARY LITHIUM-SODIUM SILICATES. S.W.Strauss. J. Res. Nat. Bur. Stand., Vol. 56, No. 4, 183-5 (April, 1956).

Resistivities of vitreous lithium disilicate, sodium disilicate, and selected ternary lithium-sodium silicates were measured in the range 150° to 230°C. The resulting data are given as log resistivity—composition isotherms. A correlation between heats of activation and composition is also presented. The composition containing approximately equimolar quantities of lithium oxide and sodium oxide showed a maximum value on the resistivity—composition isotherms as well as on the heat of activation—composition curve. The resistivities of the glasses were interpreted in terms of the structure of glass. A.

537.311.32 : 539.185.9

7397. RADIATION DAMAGE TO THE ELECTRICAL CONDUCTIVITIES OF NATURAL GRAPHITE CRYSTALS. W.Primak and L.H.Fuchs. Phys. Rev., Vol. 103, No. 3, 541-4 (Aug. 1, 1956).

When natural graphite crystals were exposed in nuclear reactors, it was found that the a-axis electrical conductivity decreased progressively and monotonically, eventually about twenty-fold. The c-axis electrical conductivity decreased by

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a factor of about three to a minimum and then slowly increased somewhat. Very early in the irradiation, the temperature dependence of the conductivities altered to a negligible dependence on temperature, indicating the spacing of fixed scattering centres in the original crystals was at least hundreds of atomic spacings. The approximate values of the crystallite conductivities in artificial graphite are inferred from the results obtained for the natural graphite crystals. A.

537.311.33

7398. NOTE ON A SIMPLIFIED MODEL FOR STUDYING THE PHOTOMAGNETOELECTRIC EFFECT IN THE CASE OF A STRONG MAGNETIC FIELD. J.Lagrenaudie and A.A.Pires de Carvalho.
Ann. Télécomm., Vol. 11, No. 6, 127-30 (June, 1956). In French.

For the case of a circuit having only a small external resistance, it is shown that for some values of the parameters the current will rise asymptotically to a limit as the magnetic field increases; for other values of the parameters the current will at first increase with increasing magnetic field and will then diminish. P.M.Davidson

537.311.33

7399. THE PHOTOMAGNETOELECTRIC EFFECT. J.Lagrenaudie.
Ann. Télécomm., Vol. 11, No. 6, 132-9 (June, 1956). In French.

With the aid of some simplifying assumptions, the theory of the photomagnetoelectric effect is developed for the case of a weak magnetic field and is applied to experimental arrangements having both steady and transitory illuminations. The use of the effect in determining the characteristics of various semiconductors is considered and also the possibility of using the effect for converting the energy of light into electrical energy. Related effects, including the Dember and magneto-Dember effects, are also treated. P.M.Davidson

537.311.33 : 621.315.59

7400. INTERMETALLIC SEMICONDUCTORS. H.J.Hrostowski.
Bell Lab. Record, Vol. 34, No. 7, 246-50 (July, 1956).

A survey of current progress in the group III-group V compounds and a general discussion of their electrical properties in comparison with those of Ge and Si. W.Bardsley

537.311.33

7401. ELECTRONIC PHENOMENA IN SEMICONDUCTORS WITH A TEMPERATURE GRADIENT. J.Tauc.
Czech. J. Phys., Vol. 6, No. 2, 108-23 (April, 1956).

Phenomena connected with the transfer of current carrier concentrations as a result of a temperature gradient in semiconductors with two kinds of current carriers are theoretically studied. The paper first deals with the general equations which are valid at a certain point of the semiconductor with a temperature gradient for the concentrations of current carriers and density of electric and thermal current. From this the distribution of the concentrations of current carriers is found for a typical case, the phenomenon of thermal emission of minority current carriers is discussed, relations are derived for the dependence of the thermal e.m.f. on the magnitude of the temperature gradient, the possibility of thermal rectification is discussed and equations are given for the thermal conductivity of a semiconductor with non-equilibrium concentrations of current carriers. A.

537.311.33

7402. ON THE LOW TEMPERATURE CONDUCTION PHENOMENA IN SEMICONDUCTORS. S.Koshino.
J. Phys. Soc. Japan, Vol. 11, No. 5, 608 (May, 1956). In French.

This note shows that the excited-bands model of Erginsoy (Abstr. 3519/1951) can be used to explain the experimental observations by Fritzsche (Abstr. 7954/1955) in germanium doped with 10^{16} atoms per cm^3 of gallium of the three regions appearing in the plot of log ρ v. 1/T and the two maxima in the curve of log R v. 1/T, where ρ is the resistivity, T the absolute temperature and R the Hall coefficient. W.Bardsley

537.311.33

7403. CONDUCTIVITY AND HALL EFFECT IN SEMICONDUCTORS. G.Della Pergola.
Ricerca sci., Vol. 25, No. 12, 3269-3314 (Dec., 1955). In Italian.

Drude's elementary theory of conductivity and Hall effect in semiconductors is presented as well as the more recent theory based on statistical and quantum mechanics. Charge carrier concentration as function of temperature and dynamics of different collision processes are discussed in order to study the temperature dependences of conductivity and Hall effect. A short review of the methods used for measurements and of the more important experimental results for germanium and silicon is given. A.

537.311.33

7404. ON THE INTERACTION OF ELECTRONS AND HOLES IN NON-POLAR SEMICONDUCTORS. D.Dorn.
Z. Naturforsch., Vol. 11a, No. 5, 383-6 (1956). In German.

The interaction of electrons in the potential field of the holes with holes in the potential field of the electrons is analysed to estimate the effect on the electrical conductivity at temperatures where lattice scattering is dominant. C.A.Hogarth

537.311.33

7405. THE EFFECT OF ADDITIVES ON THE PROPERTIES OF GALLIUM ANTIMONIDE. K.Šmirous.
Czech. J. Phys., Vol. 6, No. 1, 39-44 (Jan., 1956). In German.

GaSb was prepared by combination of the elements followed by repeated zone refining and the growth of single crystals from the melt. p-Type material of conductivity 12 $ohm^{-1}cm^{-1}$ resulted, the Hall effect indicating 10^{16} to 10^{17} residual impurities per cm^3. Addition of approx. 2×10^{19} atoms per cm^3 of Zn, Cd or Cu induced p-type conductivity in n-type (Te-doped) material, while the addition of Se or Te induced n-type conductivity in p-type material. Ag, Au or excess Ga or Sb did not alter the conductivity type although influencing its value. The type of conduction was determined by thermoelectric measurements, using a heated probe. K.W.Plessner

537.311.33

7406. EVIDENCE FOR HOLE-MOBILITY IN CdS. G.Diemer and W.Hoogenstraaten.
Physica, Vol. 22, No. 3, 172 (March, 1956).

A narrow line of u.v. was projected on a CdS single crystal, the rest of the crystal being screened from scattered light. A strong increase in conductivity of the whole inter-electrode space was observed, which was attributed to migrating holes which compensate the space charge of the electrons. L.Pincherle

537.311.33

7407. THE EFFECT OF NEUTRONS ON AN INDIUM PHOSPHIDE P-N JUNCTION. R.Gremmelmaier and H.Welker.
Z. Naturforsch., Vol. 11a, No. 5, 420-2 (May, 1956). In German.

Slow neutrons up to a flux value of $10^9 cm^{-2} sec^{-1}$ were used and the output voltage, initially of order 1000 μV, but decreasing with increasing time, was measured as a function of time. The reaction of indium with neutrons is discussed. The decay of junction voltage occurs in two stages, an initial decay with a half-life of 13 sec and a final decay with a half-life of 54.2 min. The last figure agrees with the decay of In^{116}. C.A.Hogarth

537.311.33

408. MEASUREMENTS OF SURFACE ELECTRICAL ROPERTIES OF BOMBARDMENT-CLEANED GERMANIUM. .T.Law and C.G.B. Garrett.
. appl. Phys., Vol. 27, No. 6, 656 (June, 1956).

Reports preliminary results of the measurement of: l) the surface recombination velocity (s) after cleaning; !) the changes in s and of surface conductance (σ) on exosing the surface to oxygen. Both s and σ are plotted as function of oxygen pressure. The cleaning technique ollows the ion-bombardment technique of Farnsworth et al. Abstr. 4993/1955). The oxygen is thought to lower the surice barrier. It is suggested that surfaces cleaned this way ave a monolayer of oxygen form on them before measureients can be made. W.Bardsley

537.311.33

'409. ANNEALING OF GERMANIUM SUPERSATURATED VITH NICKEL. P.Penning.
Phys. Rev., Vol. 102, No. 5, 1414-15 (June 1, 1956).

A report on experiments designed to determine how the hange in density of nickel acceptor levels takes place during nnealing at 430°C, by measuring the Hall effect as a function of temperature. It is found that the 0.23 eV acceptor levels lisappear on annealing and acceptor levels with a lower actiation energy appear in their place. The density of the new cceptor levels increases rapidly with increasing annealing ime, then reaches a maximum, followed by an exponential lecrease. T.P.Brody

537.311.33

7410. RELAXATION TIME OF SURFACE STATES ON GERMANIUM. R.H.Kingston and A.L.McWhorter.
Phys. Rev., Vol. 103, No. 3, 534-40 (Aug. 1, 1956).

Two types of state exist at the surface of single crystal germanium; the first type, which is assumed to be at the semiconductor–oxide interface, is chiefly responsible for the carrier recombination process, while the second type, associated with the oxide structure and adsorbed ions, is believed to control the position of the Fermi level at the surface with respect to the electron band energy. The latter type of state has been studied by means of the "field-effect", or change in conductance with an applied field perpendicular to the surface. The results indicate that the relaxation or capture time of these states is much longer than that of the interface states, and is also extremely sensitive to surface treatment and ambient gas. In addition, some surface treatments lead to a distribution of time constants on the same surface over a range as large as six decades. Possible physical models for this behaviour are discussed as well as its connection with excess or 1/f noise A.

537.311.33

7411. FIELD-INDUCED CONDUCTIVITY CHANGES IN GERMANIUM. H.C.Montgomery and W.L.Brown.
Phys. Rev., Vol. 103, No. 4, 865-70 (Aug. 15, 1956).

Variations in the conductance of a germanium filament due to an electric field normal to the surface were measured for fields up to 10^5 volts/cm. Observation of a minimum in the conductance curve makes it possible to calculate charge in surface states as a function of surface potential. Information of this sort obtained with several gaseous ambients is compared with the Brattain–Bardeen observations on contact potential. Measurements as a function of temperature down to 170° K give information about properties of "fast" surface states. Phase shift loops observed at frequencies around a kilocycle are interpreted in terms of minority carrier lifetime. Phase shift loops at low temperatures are believed to be due to traps. A.

537.311.33 : 535.343

7412. THE CONTRIBUTION OF FREE CHARGE CARRIERS TO THE LIGHT ABSORPTION IN GERMANIUM. J.Jaumann and R.Kessler.
Z. Naturforsch., Vol. 11a, No. 5, 387-95 (1956). In German.

This follows the Drude–Fröhlich formula with respect to temperature and number of carriers. Quantitatively a correction of 200 for electrons and of 2000 for positive holes must be made. G.F.J.Garlick

537.311.33 : 621.314.7

7413. THE RELATIONSHIP BETWEEN SURFACE AND VOLUME RECOMBINATION IN GERMANIUM TRIODES WITH ALLOYED P-N JUNCTIONS. A.O.Rzhanov.
Zh. tekh. Fiz., Vol. 26, No. 1, 239-40 (1956). In Russian.

The variation of current gain with effective base thickness for a typical triode was found to be linear over a wide range. Since the volume recombination should lead to a square law dependence its effect was assumed to be negligible. Triodes prepared from materials with a wide range of diffusion length, L, showed departures from this linear relationship only if $L < 0.01$ cm. C.H.L.Goodman

537.311.33 : 539.172 : 538.244.2

MAGNETORESISTANCE OF GERMANIUM AT 600 000 GAUSS. See Abstr. 6789

537.311.33

7414. PREPARATION OF INDIUM ANTIMONIDE. DETERMINATION OF EFFECTIVE MASSES. M.Rodot, P.Duclos, F.Kover and H.Rodot.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2522-5 (May 23, 1956). In French.

Samples have been prepared with different purities down to 10^{15} impurities/cm^3. Measurements of the Hall effect and the Seebeck effect were made which allowed the effective masses of holes and electrons to be determined at room temperatures. The values thus obtained were found to depend markedly on the temperature as follows

T°K	m_n	m_p
313	0.026	0.21
283	0.023	0.24
263	0.019	0.29

W.Bardsley

537.311.33

7415. INDIRECT TRANSITIONS IN INDIUM ANTIMONIDE. R.F.Potter.
Phys. Rev., Vol. 103, No. 4, 861-2 (Aug. 15, 1956).

An interpretation of published infrared absorption data for InSb is made. It is proposed that the absorption beyond the main optical edge is due to indirect transitions involving both optical mode and low-energy acoustical mode phonons. A.

537.311.33

7416. RECOMBINATION THEORY FOR INDIUM ANTIMONIDE. P.T.Landsberg and T.S.Moss.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 661-9 (June, 1956).

The theory of the recombination of holes and electrons via traps is extended to include the effect of degeneracy. Special attention is paid to the examble of InSb. Values for the radiation lifetime for specimens of various carrier concentrations are also calculated. A.

537.311.33

7417. HALL EFFECT AND ELECTRICAL RESISTANCE OF InSb AT STRONG MAGNETIC FIELDS AND HIGH PRESSURES. J.Gielessen and K.H. v.Klitzing.
Z. Phys., Vol. 145, No. 2, 151-5 (1956). In German.

Reports measurements up to magnetic fields of 14 000 oersted and pressures of 7400 atmospheres. The resistivity increases markedly with magnetic field and with applied pressure. The Hall coefficient increases only slightly with magnetic field at constant applied pressure but increases steadily with applied pressure. C.A.Hogarth

537.311.33

7418. EFFECTS OF LOW-ENERGY GAS DISCHARGES ON EVAPORATED METAL-SEMICONDUCTOR CONTACTS. P.A.Hartig and R.N.Noyce.
J. appl. Phys., Vol. 27, No. 8, 843-7 (Aug., 1956).

Exposure of the surface of chemically clean 5 ohm-cm germanium to a low-energy gas discharge prior to evaporating on to it a platinum diode produced results dependent on the gas used. Exposure of n-type material to an oxygen or nitrogen discharge destroyed rectification completely; exposure to a hydrogen or argon discharge not only maintained it but tended to counteract the effect of the former gases. These results indicate that such oxygen and nitrogen bombardment lower the effective barrier, making the surface more n-type, but hydrogen and argon bombardment make it more p-type. This can be explained by the introduction of gas-dependent interface states. A.

537.311.33

7419. QUENCHED-IN RECOMBINATION CENTERS IN SILICON. G.Bemski.
Phys. Rev., Vol. 103, No. 3, 567-9 (Aug. 1, 1956).

Measurements of lifetimes of minority carriers in p- and n-type silicon indicate that quenching from temperatures above 400° C introduces recombination centres. The energy of formation of these centres is about 0.6 eV. These centres anneal at temperatures in the neighbourhood of the quenching temperatures with an activation energy for annealing of about 0.8 eV. A.

537.311.33 : 535.343

CONCENTRATION EFFECTS OF THE LINE SPECTRA OF BOUND HOLES IN SILICON. See Abstr. 6527

537.311.33 : 537.312.5

7420. STUDY OF CRYSTALLINE Zn_3P_2 AT LOW TEMPERATURES. J.Lagrenaudie.
J. Phys. Radium, Vol. 17, No. 4, 359-62 (April, 1956). In French.

Low-temperature studies of conductivity in zinc phosphide show the existence of trapping states of different levels. Measurements are made of photoconductivity, conductivity "glow curves", decay curves for photocurrent and the photo-magnetic effect. An energy level scheme is constructed from the experimental data. G.F.J.Garlick

537.311.35

7421. ANALOGIES BETWEEN PHENOMENA DUE TO CONDUCTION CURRENTS IN INSULATING LIQUIDS, BETWEEN ELECTRODES COVERED WITH A THIN FILM OF VARNISH AND DIFFUSION PHENOMENA. R.Guizonnier.
C.R. Acad. Sci. (Paris), Vol. 242, No. 22, 2631-3 (May 28, 1956). In French.

Tests with CCl_4 and transformer oil show that after the application of voltage charges are trapped on the varnish layers on the electrodes, giving rise to residual potential whose magnitude varies with the time of voltage application in the same manner as the curves of diffusion in these liquids. J.H.Mason

537.311.62

7422. CYCLOTRON RESONANCE UNDER ANOMALOUS SKIN EFFECT CONDITIONS. R.G.Chambers.
Phil. Mag. (Ser. 8), Vol. 1, No. 5, 459-65 (May, 1956).

Discusses the results to be expected from attempts to observe cyclotron resonance in metals. A brief summary is first given of the simple theory for a free-electron model, assuming the classical skin-effect equations to hold. Theoretical results are then given for a free-electron model under anomalous skin effect conditions, and a qualitative discussion is given of the results to be expected for a real metal under these conditions. A.

537.312.5

7423. CURRENT DEPENDENCE OF THE SUPERCONDUCTING TRANSITION. D.C.Baird.
Canad. J. Phys., Vol. 34, No. 7, 725-7 (July, 1956).

The resistance transition of a Sn wire (0.5 mm diameter) was measured for various measuring currents from 1 to 600 mA. At all currents the transition was about 0.04° K wide; increasing the current from 1 to 600 mA displaced the transition curve downwards by about 0.04° K. The results are shown not to fit the simple London theory for an ideal superconductor. R.G.Chambers

537.312.5

7424. A CONTRIBUTION TO THE KINETICS OF THE PHOTOCONDUCTIVITY OF SELENIUM. K.Pátek.
Czech. J Phys., Vol. 6, No. 2, 152-63 (April, 1956). In Russian.

The rise and decay of the photoconductivity of hexagonal selenium, both single and polycrystalline, with the elimination of secondary effects was studied by Zhuze and Ryvkin's method of square-wave interrupted illumination which was achieved with a bulb having a red filter, the light being interrupted by a rotating disk. The temperature of the sample was varied from +65° C to −130° C. It was found that the photoconductivity of selenium can be divided into at least three components characterized by the relaxation times = 10^{-2}–10^{-3} sec (determined and measured by several authors), 0.1–0.3 sec, 1 min. A detailed measurement of the second component was carried out. Measurement showed the relaxation time to be about 0.1 to 0.2 sec for single crystals and 0.2 to 0.3 sec for polycrystalline specimens, constant in the whole temperature range. The stationary value of the photoconductivity of this component varies little above −95° C, and then shows an exponential decrease $\Delta\sigma_0 = A\exp(\epsilon/kT)$, where ϵ has values around 0.025–0.05 eV. The quantum yield, estimated from the assumed spectral distribution of the sensitivity, was about 0.03 on the assumption that the mobility of the current carriers is b = 0.7 cm^2/volt.sec. It is shown that the measured results cannot be explained by the assumption that the carriers of the photo-current of this component are holes, due to the great dependence of their mobility on the temperature, and a model is proposed in which the photoconductivity is explained by electrons excited by light to the traps and from there by heat to the conductivity band. A.

537.312.5

7425. THE INFLUENCE OF ILLUMINATION ON THE CONDUCTIVITY AND PHOTOCONDUCTIVITY OF Cu_2O.
J.Pastrňák and R.Kužel.
Czech. J. Phys., Vol. 6, No. 3, 217-36 (June, 1956). In Russian.

It is shown that by heating a sample of Cu_2O to a temperature of 130 to 200° C its conductivity decreases to a certain constant value. After illuminating the sample the conductivity is again permanently increased. Simultaneously with the conductivity the photoconductivity of the pre-illuminated and heated samples is also investigated. The results of the experiments can be explained on the basis of a model which assumes that the lattice defects determining the conductivity in the dark attain on heating an equilibrium between the associated complexes and the dissociated centres. Illumination shifts the balance in the equilibrium in favour of the dissociated centres. The associated centres serve in the conduction mechanism as traps. A.

537.312.5 : 537.321

7426. THE THERMAL PHOTO-ELECTRIC PHENOMENON IN SEMICONDUCTORS. J.Tauc.
Czech. J. Phys., Vol. 5, No. 4, 528-36 (Dec., 1955).

On illuminating homogeneous samples cut from single crystals of germanium an e.m.f. was observed when a thermal current flowed through them. This phenomenon was called a "thermal photoelectric phenomenon" and is caused by the fact

hat illumination changes the thermal e.m.f. of the semiconductor. Using equations from the thermodynamics of irreversible processes a theory of this phenomenon was elaborated. Its conclusions are in agreement with the preliminary measurements. It is shown that the measurement of a thermal photo-e.m.f. renders possible the determination of $Q^*_1 + Q^*_2$ where Q^*_1, Q^*_2 are the mean kinetic energies transferred by the electron and hole respectively. The type of scattering of the current carriers can be judged from the magnitude of $Q^*_1 + Q^*_2$. A.

537.312.5

7427. POTENTIAL DISTRIBUTION AND LOCALIZED PHOTOEFFECTS IN ZINC SULFIDE SINGLE CRYSTALS. A.Lempicki.
J. Opt. Soc. Amer., Vol. 46, No. 8, 611-14 (Aug., 1956).

Potential distributions in synthetic zinc sulphide crystals have been measured and correlated with photoconductive regions found by light scanning experiments. Crystals having uniform potential distributions are found to have peak photosensitivity in their middle. An interpretation based on non-uniform light absorption is proposed. A.

537.312.6

7428. ISOTHERMAL CHANGES WITH TIME OF THE ELECTRICAL CONDUCTIVITY OF POLYCRYSTALLINE SELENIUM FOLLOWING SUDDEN CHANGES IN TEMPERATURE. I. P.T.Kozyrev.
Zh. tekh. Fiz., Vol. 26, No. 2, 255-65 (1956). In Russian.

After sudden heating or cooling of the specimens, marked progressive changes in conductivity (σ) were observed. These non-equilibrium values of σ could exceed that at equilibrium which was characteristic for a given specimen and temperature, and was but slowly approached) by a factor >10. Plots of σ against time for various changes of temperature are given. A method of stabilizing σ for devices working at a reasonably constant temperature (e.g. photoresistances) is suggested. C.H.L.Goodman

537.312.6

7429. ISOTHERMAL CHANGES WITH TIME OF THE CARRIER CONCENTRATION AND ELECTRICAL CONDUCTIVITY OF POLYCRYSTALLINE SELENIUM FOLLOWING SUDDEN CHANGES IN TEMPERATURE. II. P.T.Kozyrev.
Zh. tekh. Fiz., Vol. 26, No. 2, 266-72 (1956). In Russian.

Simultaneous measurements of the electrical conductivity and the thermoelectric power on specimens subjected to sudden changes of temperature were used to derive the variation with time of the carrier concentration and mobility (see Abstr. 7878, 1951). The increased hole concentration always observed after changes in temperature was ascribed to grain-boundary strain arising from the known marked anisotropy in thermal expansion of Se. C.H.L.Goodman

537.312.62

7430. THE TRANSITION TO SUPERCONDUCTIVITY. F.R.Doidge.
Phil. Trans. A, Vol. 248, No. 954, 553-73 (1956).

Magnetic and electrical measurements have been made of the effect of impurity on the transitions to superconductivity in tin. Reproducible results were obtained only with well-annealed monocrystalline specimens. Solution of up to 6% indium in pure tin decreases the electronic mean free path l from about 3×10^{-3} to 3×10^{-6} cm, and over this range magnetic measurements show that there is only a small depression of the transition temperature T_c and a small alteration in the critical field curve of H_c and T. Electrical measurements show that if $l > l_c$, where $l_c = 8 \times 10^{-6}$ cm, the resistance transitions are sharp and almost concurrent with the magnetic transitions. However, if $l < l_c$ superconducting nucleation apparently occurs, since a state of partial superconductivity exists with zero resistance, but no exclusion of magnetic induction, in fields greater than H_c but less than H'_c, where it has been found that at any one temperature $H_c/H'_c = l/l_c$. This relation describes in broad outline the dependence of H'_c on l and temperature, although the interpretation of the results is complicated by considerable broadening of the resistance transitions and the appearance of a sensitive non-linear dependence on the measuring current of the temperature of nucleation. These complicating effects may wholly or partly be due to inhomogeneities in indium concentration. The concept of a range of coherence ξ of the superconducting phase is used in formulating the thermodynamic conditions for the formation in a magnetic field of superconducting nuclei with cylindrical and spherical symmetry. It is shown that the main features of superconducting nucleation in homogeneous tin-indium alloys can be accounted for if $\xi = \frac{2\lambda_0 l}{l_c(1-t^4)^{1/2}}$, where $t = T/T_c$ and λ_0 is the penetration depth at 0^0K. The implication that ξ greatly exceeds l just below T_c is supported by a consideration of the sharpness of resistance transition and the shape of the critical field curve near T_c. The formula for ξ resembles that given in Pippard's phenomenological theory of superconductivity (1953). A.

537.312.62

7431. MAGNETIC ENERGY AND ELECTRON INERTIA IN A SUPERCONDUCTING SPHERE. E.G.Cullwick.
Proc. Instn Elect. Engrs, Monogr. No. 184, publ. June, 1956 (Vol. 103 C, 441-6).

Republication of the monograph abstracted in Abstr. 5108 (1956).

537.312.62 : 537.226.2

7432. DETERMINATION OF THE DIELECTRIC CONSTANT OF SUPERCONDUCTORS. M.Ya.Azbel'.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 705-7 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 354-6 (March, 1956).

It is shown that Abrikosov's (Abstr. 5483/1953) expression for the surface impedance Z of a superconductor becomes much more complicated if the dielectric constant ϵ and penetration depth are taken to be tensors instead of scalars; ϵ can no longer be deduced from measurement of Z alone. It is suggested that this explains why Galkin and Kaganov (1953), using Abrikosov's theory to interpret measurements of Z, found no evidence for the very high ϵ predicted by Ginzburg (Abstr. 5125/1952). R.G.Chambers

537.312.62

7433. COMMENTS ON THE MACROSCOPIC THEORY OF SUPERCONDUCTIVITY. V.L.Ginzburg.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 593-5 (1956). In Russian.

A formula for the free energy of superconductors is put forward. It is argued that its theoretical foundations are reasonably safe and that it is less cumbersome to handle mathematically than the alternative formulae which have been deduced from fundamental theory. Comparison with experiment, in particular with data for aluminium and tin, is not unfavourable. R.Eisenschitz

537.32 : 536.21 : 548.52

THERMOELECTRIC POWER OF SINGLE CRYSTAL Bi_2Te_3. See Abstr. 7010

537.322.1 : 537.311.33

7434. TWO NEW APPLICATIONS OF THE PELTIER EFFECT. A.F.Ioffe.
Zh. tekh. Fiz., Vol. 26, No. 2, 478-82 (1956). In Russian.

A theoretical paper in two sections. (1) Crystallization. The difference in thermoelectric power between a solid and its own liquid implies a generation or absorption of heat, by Peltier effect, on passing d.c. across the interface. The absorptive effect can be used to remove latent heat of solidification and so to assist crystallization of the liquid. Calculations on the effect are made for Zn, Bi, Cs and Ge, and crystalli-

zation velocities of several cm/hr are predicted. Application to zone melting is suggested; a molten zone once formed in a bar held just at its melting point would be made to move by the passage of d.c. through it, since crystallation would be induced at one end of the zone and melting at the other.
(2) Mechanical deformation. The passage of a.c. through a semiconducting plate generates thermal oscillations due to Peltier heating and cooling at the electrodes. For a particular frequency and plate thickness a standing thermal wave system with a nodal plane half-way between the electrodes can be obtained. Thermal expansion and contraction away from the node generate mechanical oscillations, which can be at sonic frequencies. Mechanical deformation in thermoelectric devices operating with d.c. is also considered.
C.H.L.Goodman

537.323

7435. THE THERMOELECTRIC PROPERTIES OF METAL-AMMONIA SOLUTIONS. II. THE THERMOELECTRIC POWER OF SODIUM AND POTASSIUM SOLUTIONS AT −78° AND THE EFFECT OF ADDED SALT ON THE THERMOELECTRIC POWER OF SODIUM AT −33°. G.Lepoutre and J.F.Dewald.
J. Amer. Chem. Soc., Vol. 78, No. 13, 2953-5 (July 5, 1956).
For Pt I, see Abstr. 10201 (1954). Measurements of the thermoelectric power of sodium and potassium solutions in liquid ammonia at −78° and of mixed sodium-sodium chloride solutions at −33° are reported. The results in dilute solution show an anomalously large dependence of thermoelectric power on temperature and on concentration of salt, as well as a small but significant dependence on the nature of the metal ion. A.

537.323

7436. THE THERMOELECTRIC PROPERTIES OF METAL-AMMONIA SOLUTIONS. III. THEORY AND INTERPRETATION OF RESULTS. J.F.Dewald and G.Lepoutre.
J. Amer. Chem. Soc., Vol. 78, No. 13, 2956-62 (July 5, 1956).
Thermodynamic equations are derived for the thermoelectric power of metal-ammonia solutions which include the effects of electron-electron and electron-ion interactions. The previously reported anomalies in thermoelectric behaviour of metal and metal-salt solutions are shown not to arise from these interactions, but rather from a large negative heat-of-transport of the electrons in these solutions ($Q_e^* \cong -0.7$ eV). This large negative heat-of-transport is accounted for on the assumption that electrons move through the solutions, even at high dilution, by a quantum tunnel process, rather than by the previously considered ionic, or conduction-band processes.
A.

ELECTRIC DISCHARGES 537.52

537.52

7437. ON PLASMA OSCILLATIONS IN AN EXTERNAL ELECTRIC FIELD. A.I.Akhiezer and A.G.Sitenko.
Zh. éksper. teor. Fiz., Vol. 30, No. 1, 216-17 (1956). In Russian.
From the transport equation for the distribution function $F(\vec{r}, \vec{v}, t)$ given in the form

$$\partial F/\partial t + \vec{v}\ \mathrm{grad}\ F + (e/m)(\vec{E}_0 + \vec{E})\partial F/\partial \vec{v} + J(F) = 0,$$

where J = the collision integral and where the electric field $\vec{E}$ is given by $\mathrm{div}\ \vec{E} = 4\pi e \int F\, d\vec{v} - 4\pi e n_0$ (n_0 the average plasma density) dispersion relations are deduced for the cases of strong and weak external field $\vec{E}_0$. In the latter case the authors find

$$\omega = \Omega + k^2 s^2/2\Omega + (8/3\pi)^{1/2} e\vec{E}_0 \vec{k} l/ms,$$

and in the former

$$\omega = \Omega + \tfrac{1}{2}\frac{\Gamma(\frac{5}{3})}{\Gamma(\frac{7}{3})}\frac{k^2\sigma^2}{\Omega} + \frac{4}{3}\frac{\Gamma(\frac{5}{3})}{\Gamma(\frac{7}{3})}\frac{e\vec{E}_0\vec{k}l}{m\sigma}.$$

In these formulae Ω = the plasma frequency, l = the mean free path, T = the temperature, M and m are the ion and electron masses respectively,

$s = (3T/m)^{1/2}$ and $\sigma = (4M/3m)^{1/4}(e\vec{E}_0 l/m)^{1/2}$,

ω = the frequency and $\vec{k}$ = the propagation vector. The collision term is approximated by an expression f/τ, where τ the average time between collisions. H.Motz

537.521.5 : 621.3.015.5

7438. SURGE VOLTAGE BREAKDOWN OF AIR IN A NON-UNIFORM FIELD. J.H.Park and H.N.Cones.
J. Res. Nat. Bur. Stand., Vol. 56, No. 4, 201-24 (April, 1956).
The discharge and breakdown phenomena in air when a surge voltage is applied to sphere-plane electrodes were investigated. A steeply rising surge of 145 kV peak value was applied to the plane placed 86 cm above the laboratory floor. A 1.6 cm diameter sphere, mounted an adjustable distance below the plane, was connected to ground through the surge impedance of a coaxial cable. Experimental data consisted of oscillograms of the current to the sphere and pictures of the discharge between the electrodes. A method for chopping the applied voltage surge at an accurately controllable time was used to study the discharge at gap spacings for which a full-wave applied surge would cause breakdown. Complete breakdown did not occur for gap spacings greater than 28 cm, sphere positive, or 20 cm, sphere negative. But at gap spacings up to 56 cm, sphere positive, and 46 cm, sphere negative, discharge streamers (corona) did develop from the sphere and they were accompanied by short pulses of current to the sphere. At gap spacings near those giving breakdown, these initial streamers span the gap without yielding breakdown. Measured speeds of formation of these initial streamers were found to be 500 cm per microsecond for the sphere negative and 800 cm per microsecond for the sphere positive. For shorter gap spacings the discharge leading to breakdown is illustrated by the data obtained with the applied voltage chopped. Bright conducting channels develop between the sphere and plane. At the same time the current to the sphere starts to rise again fairly slowly at first and then at an increasing rate up to breakdown. The mechanism leading to breakdown is not the same for the sphere negative as for the sphere positive, and it is different for very short gaps which correspond to high overvoltage. An attempt is made to explain how the initial streamers form and how the channels leading to breakdown develop. A.

537.521.7

7439. HIGH-FREQUENCY GAS DISCHARGE BREAKDOWN IN NEON—ARGON MIXTURES. H.J.Oskam.
J. appl. Phys., Vol. 27, No. 8, 848-53 (Aug., 1956).
Breakdown electric fields in a waveguide at 9500 Mc/s are presented for a number of neon—argon mixtures at various pressures. The argon percentage is found to have a large influence on the breakdown electric field, just as Penning found for the d.c. discharge. For each argon concentration, only one minimum is found in the curves giving breakdown field as a function of pressure. This result contrasts with the two minima found in the d.c. discharge for some neon—argon mixtures. This can be explained by the difference between the efficiency of energy transfer from the electric field to the electrons in the d.c. case and the high-frequency case. The relation between the concentration of argon and the breakdown fields is discussed. The influence of electric field distortions and the standing-wave ratio in the waveguide are investigated. A.

537.521.7 : 621.3.014.31

7440. ON THE ROTATING ARC SPOT ON A CARBON ANODE. W.Lochte-Holtgreven.
Z. Phys., Vol. 145, No. 4, 451-5 (1956). In German.
Theoretical discussion of the wandering of the anode spot of an arc in terms of the corona rotation effect previously discussed by Guntherschulze et al. (Z. Phys., Vol. 97, No. 1-2, 113-23 (1935); ibid., Vol. 98, No. 7-8, 476-89 (1936) and Vol. 100, No. 3-4, 269-72, 1936). J.Dutton

537.523.4 : 537.527.5

7441. FORMATION OF THE HIGH PRESSURE ARC COLUMN IN HYDROGEN. W.A.Gambling and H.Edels.
Nature (London), Vol. 177, 1090-1 (June 9, 1956).

Describes spectroscopic measurements on the high-pressure glow and the constricted channel discharge in hydrogen at 1 atmosphere pressure (0 — 5A). Column voltage gradients and current densities are quoted. There is a very brief discussion. J.D.Craggs

537.523.5

7442. PROPERTIES OF A D.C. ARC IN A MAGNETIC FIELD. L.P.Winsor and T.H.Lee.
Trans Amer. Inst. Elect. Engrs I, Vol. 75, 143-8 (1956) = Commun. and Electronics, No. 24 (May, 1956).

Describes observations of the effect of a 200 gauss external magnetic field, the axis of which was perpendicular to the length of the discharge, on arcs in air carrying currents up to 100 A. The movements of the arc in the field, along strip electrodes, were studied. Electrode effects (spot movements etc.) were investigated and are described. J.D.Craggs

537.525 : 537.226.8

7443. PRE-BREAKDOWN CURRENT AND VACUUM BREAKDOWN. W.J.R.Calvert.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 651-60 (June, 1956).

An account is given of measurements of the development of current between un-outgassed electrodes at distances up to 4.5 cm with uniform electric fields at voltages up to 100 kV at pressures of the order of 10^{-5} mm Hg. Four distinct stages of development were noted: (i) an initial pre-breakdown stage in which a cold emission of electrons under electric fields of the order of 10^5 V.cm^{-1} took place; (ii) the occurrence of discharge pulses of the order of 10^{-7} C at a critical voltage; (iii) larger, repetitive pulses of the order of 10^{-6} C at a slightly higher voltage accompanied by X-ray generation and the release of gas, and (iv) complete breakdown in which the current was determined by circuit constants at a still higher voltage. The pulse threshold voltage for large gaps was determined by the total gap voltage. The development of the field emission initiated arc is discussed in terms of the particle exchange theory and the importance of X-rays and photons and of the release of gas are discussed. A.

537.525

7444. THE QUESTION OF THE POSSIBILITY OF MEASURING THE TEMPERATURE OF THE COLUMN OF A JET DISCHARGE USING THE 3064 A HYDROXYL BAND. M.Z.Khokhlov.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 645-50 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 559-64 (May, 1956).

It is shown that measurements of the temperature of the column of a jet discharge at pressures greater than 100 mm Hg using the 3064 A hydroxyl band yield the temperature of the neutral gas. This is connected with the predominant role of thermal dissociation of water at the pressures indicated as compared with dissociation due to the action of fast electrons with simultaneous excitation of the hydroxyl which is formed. A.

537.525 : 537.222

THE "WALL EFFECT" OF ELECTRON AVALANCHES.
See Abstr. 6587

537.525.5

7445. ARCS IN VACUUM. M.P.Reece.
Nature (London), Vol. 177, 1089-90 (June 9, 1956).

Describes experiments with vacuum arcs (2 to 50 A) between electrodes of various metals. Data on arc voltage drops are given. Photomicrographs of cathode tracks are shown and briefly discussed. J.D.Craggs

537.525.8

7446. OSCILLATING GLOW DISCHARGE PLASMA. A.B.Stewart.
J. appl. Phys., Vol. 27, No. 8, 911-16 (Aug., 1956).

The plasma potential, electron temperature, and electron concentration have been measured as functions of both time and position in the positive column of an argon glow discharge with moving striations using a plane circular probe 0.25 mm in diameter that could be saturated in the electron collecting region. It is found that (1) the radial distribution of charge is that predicted by the ambipolar diffusion theory, (2) in each cycle, close to the time of the negative striation, the potential at all points in the positive column decreases sharply, (3) no increase in electron concentration occurs at the time of the negative striation. It is concluded that the positive striations move from anode to cathode as a result of ionization in front of the charge maximum combined with diffusion and drift of the charges radially and longitudinally. When the ionization function necessary to produce the observed striation motion is calculated from the observed charge concentrations, it is found to agree closely with the observed light emission of the discharge. A.

537.525.8

7447. THE STRIATED POSITIVE COLUMN. K.G.Emeléus, B.Love and A.E.Witherspoon.
J. Electronics, Vol. 1, No. 5, 559-61 (March, 1956).

A general discussion of the structure of striated positive columns of glow discharges. Axial and radial variations, for example of charged particle concentrations, are described. Oscillations are also discussed and the importance of negative ions is mentioned. J.D.Craggs

537.527

7448. ON THE DISAPPEARANCE OF THE POSITIVE CORONA EFFECT IN COMPRESSED AIR. A.Boulloud.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2542-5 (May 23, 1956). In French.

Reports measurements on discharges between positive wires and concentric cylinders for pressures p in the range 1 to 25 kg/cm^2. The results show that positive corona disappears when the value of E/p (E the field at the wire) is reduced to approximately that required to cause electron detachment. This gives quantitative confirmation of the theory previously proposed (Abstr. 9688/1955). J.Dutton

X-RAYS 537.531

537.531 : 535.343

7449. L-SPECTRA OF GALLIUM AND GERMANIUM. A.Lemasson-Lucasson.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3059-61 (June 25, 1956). In French.

Wavelength measurements of the L-α and L-β emission lines and of the L absorption edges. L.Pincherle

537.531 : 535.43

7450. ELECTRON TRANSFER TYPE MODIFIED SMEKAL LINES IN X-RAY SCATTERING ON LONG AND SHORT WAVELENGTH SIDE OF THE MONO-CHROMATISED INCIDENT X-RAY BEAM. K.Das Gupta.
Sci. and Culture, Vol. 21, No. 10, 624-6 (April, 1956).

Wavelengths of observed scattering of CuKα radiation by Si, Na, Al and O (in mica) are given: they agree closely with calculated values. A.R.Stokes

537.531 : 621.397.6

7451. VISIBLE X-RAY IMAGE PRODUCTION BY MEANS OF AN X-RAY ACTUATED TELEVISION TUBE. M.Keller and M.Ploke.

Z. angew. Phys., Vol. 7, No. 12, 562-71 (1955). In German.

Construction and properties of an X-ray image convertor using a sensitive layer of Se are described. The collecting surface of 30 x 30 cm allows pictures of large clinical subjects (e.g. a chest cavity) to be seen. Contrast of the visible picture can be altered and the picture "stored". Photographs and diagrams of the apparatus are given. Converted X-ray pictures are shown. Limitations and possibilities of the apparatus are discussed. D.V.Mabbs

537.531 : 621.386.1

7452. AN X-RAY FLASH-TUBE FOR THE PRODUCTION OF X-RAY DIFFRACTION IN A MICROSECOND. W.Schaaffs.
Z. angew. Phys., Vol. 8, No. 6, 299-302 (1956). In German.

Several improvements on previous flash-tubes (see Abstr. 7608/1950 and 502/1954) are described. It is claimed that the performance has been improved by a factor of 40. A.R.Stokes

537.531 : 535.43

7453. THE THEORY OF THE SMALL-ANGLE SCATTERING OF X-RAYS. V.N.Filipovich.
Zh. tekh. Fiz., Vol. 26, No. 2, 398-416 (1956). In Russian.

A theory of small angle X-ray scattering is developed by a new method and seems more general and more accurate than Porod's theory (G.Porod, Kolloid Zeitschrift, Vol. 121, 2, 1951). The properties of the curve of the scattered intensity plotted against angle are analysed and some typical ways of applying the theory are indicated with estimates of possible errors. The advantages of this method (φ-functions, folding) of deducing the basic formulae in demonstrating the physical meaning of the information given by the scattering from the objects studied are claimed to be apparent. A.L.Mackay

537.531.85

7454. X-RAY COMPTON SCATTERING FOR ALUMINUM. C.B.Walker.
Phys. Rev., Vol. 103, No. 3, 558-61 (Aug. 1, 1956).

The intensity of the Compton scattering has been measured for values of $\sin\theta/\lambda$ from 0.3 to 0.6 A^{-1}. The method involved a self-consistent separation into the Compton and thermal diffuse scattering of the total intensities of diffuse scattering measured at 300°K and 5°K. The measured Compton scattering is significantly lower than the intensity calculated theoretically. Limitations of the present theories are discussed. A.

CATHODE RAYS. POSITIVE RAYS 537.533/534

537.533

7455. DAMPED REGIMES OF ACCELERATION OF ELECTRONS IN MICROTRONS. E.M.Moroz.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 6, 986-7 (1956). In Russian.

In conventional microtrons the condition $2\pi V/\lambda H > 1$ imposes an upper limit to the highest attainable energy. The author shows that by an appropriate choice of the parameters defining the phase stability this limitation may be overcome. This may be done with the help of successive accelerating cycles, each one of them consisting of a given number of passages in the resonant cavity, where the particle undergoes focusing and defocusing actions. In this way the value of H may be increased and consequently also the final energy. When operating in these conditions, however, more severe controls on the stability of λ, H and V are required. G.Martelli

537.533

7456. ON THE INFLUENCE OF RADIATIVE QUANTUM FLUCTUATIONS ON THE MOTION OF ELECTRONS IN PERIODIC MAGNETIC SYSTEMS. A.A.Kolomenskii.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 3, 398-401 (1956). In Russian.

In a strong-focusing synchrotron the amplitude of betatron oscillations due to fluctuations of the radiative losses of the electrons is very small. For energies of the order of 5 BeV, for a synchrotron made of 100 sections and using a peak value of $H \cong 10^4$ gauss, $\sqrt{(\bar{A}^2)}$ (where A is the maximum deviation from the mean orbit) is of the order of 1 cm. Synchrotron oscillations due to this effect are found to be of the same order of magnitude. The theory applies also to the weak-focusing synchrotrons, having some straight sections. G.Martelli

537.533

7457. ON THE INFLUENCE OF THE RADIATION ON BETATRON OSCILLATIONS OF ELECTRONS IN STRONG-FOCUSING SYNCHROTRONS. A.N.Matveev.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 671-4 (1956). In Russian.

An approximate calculation of the amplitude of radial betatron oscillations due to radiative losses. This effect, which for a weak-focusing synchrotron would become very large with increasing energy, in the strong-focusing synchrotrons is very small even for very large values of the final energy (several BeV). The amplitude of axial oscillations may be completely neglected compared with that of radial ones (owing to the fact that the square of its value is $(E/mc^2)^2$ times smaller). It is shown that to reduce the effect of radial oscillations the peak value of the magnetic field and the total accelerating time should be also reduced. G.Martelli

537.533.2

7458. CONTROLLED FIELD EMISSION IN HEXANE. W.B.Green.
J. appl. Phys., Vol. 27, No. 8, 921-5 (Aug., 1956).

The current—voltage relationship for dielectric liquids consists of two portions, usually in superposition: at lower voltages a current of ions flows; at higher voltages, field emission sets in. The field-emission current depends on the material of the cathode, but not simply on its work function. The current may be altered by changing the thickness of the cathode surface layer or the gas adsorbed upon the surface. When the ion content of the liquid is raised, not only the ionic current, but also the field-emission portion of the current increases. Controlled field-emission currents have been produced. A.

537.533.2 : 539.234

INTERPRETATION OF THE WORK FUNCTION VALUE IN THIN METALLIC LAYERS. See Abstr. 6965

537.533.3 : 537.534.3

7459. EXAMPLES OF RIGOROUSLY SOLUBLE ION AND ELECTRON PATHS IN PLANE ELECTROSTATIC FIELDS. H.Grümm and H.Kremser.
Optik, Vol. 13, No. 7, 295-306 (1956). In German.

From the general expression (in elliptical cylindrical coordinates) of a plane electrostatic field, particular cases, leading to exact solutions for electron trajectories, are selected. These comprise (1) the field of a cylindrical condenser, and (2) a typical deflection field. The latter is treated extensively, criteria for reflection and transmission of the electrons are established, and focal properties are discussed. A.E.I. Research Laboratory

537.533.35

7460. MEASUREMENT OF THE IMAGE ROTATIONS PRODUCED BY THE LENSES OF A MAGNETIC ELECTRON MICROSCOPE. R.Miller and J.W.Sharpe.
J. appl. Phys., Vol. 27, No. 8, 860-2 (Aug., 1956).

A method of measuring the amount of rotation produced by the lenses of a three-stage electron microscope is described and the application of the results to stereo-electron microscopy discussed. A.

537.533.35

61. VARIATION OF CONTRAST IN ELECTRON MICRO-COPE IMAGES WITH SIZE OF OBJECTIVE APERTURE. H.Coupland.
oc. Phys. Soc., B, Vol. 69, Pt 6, 642-6 (June, 1956).

Measurements of the contrast in electron microscope ages show a much greater variation with size of objective erture than predicted by some of the earlier calculations. xperimental results for an inorganic object are compared th values derived from current scattering theory for the gular range $10^{-3} < \alpha < 10^{-2}$ rad, where α is the angle of attering. Better agreement is obtained, but a significant screpancy remains. A.

537.533.71

462. REFLECTION OF SLOW ELECTRONS FROM THE URFACE OF PURE TUNGSTEN AND FROM TUNGSTEN OVERED BY THIN FILMS. N.D.Morgulis and .A.Gorodetskii.
h. éksper. teor. Fiz., Vol. 30, No. 4, 667-74 (1956). In ussian.

Reflection of slow electrons from the surfaces of pure ngsten and from tungsten covered by thin films of adsorbed arium of various thickness and of adsorbed oxygen is investi-ated. Special care was taken to ensure a very high vacuum $)_{eff} \approx 10^{-10} - 10^{-11}$ mm) in the experimental tubes so that the esidual gases which condense on the surface could not percep-bly affect the experiments. The results indicate an unusual rimary electron energy, V_p, dependence of the reflection oefficient R for pure W and for O—W. Barium films adsorbed n W and possessing a density of the order or less than that of monoatomic layer were found to have a marked influence on t. A regular correlation between the threshold of the second-ry electron emission and the work function of the target was lso found. A.

537.533.74

463. BACKSCATTERING OF ELECTRONS BY SOLUTIONS ND ALLOYS. L.Danguy and R.Quivy.
. Phys. Radium, Vol. 17, No. 4, 320-5 (April, 1956). In rench.

It is shown that the backscattering of electrons (β-ray ources of Th^{204} and Cs^{137} were employed) is a function of the ffective atomic number, calculated by a simple formula from he atomic weights and atomic numbers of the atoms present n the scatterer. For liquid solutions the number of back-scattered electrons per unit time is proportional to the square oot of the product of effective atomic number and density. The results are applied to the quantitative determination of the ompositions of binary solutions. J.Thewlis

537.533.74

464. PERTURBATION CALCULATION OF THE INELAS-IC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. .Borowitz and M.M.Klein.
hys. Rev., Vol. 103, No. 3, 612-19 (Aug. 1, 1956).

A perturbation calculation has been made of the inelastic cattering of fast electrons by hydrogen atoms to the 2S and P states, using for the perturbation only the interaction be-ween the incident electron and the bound electron. The results re then compared, to leading order terms in the energy, with alculations by the more customary perturbation scheme. For irect scattering, the results for forward scattering ampli-udes are identical using either procedure. The angular dis-ribution and energy dependence are different. For exchange cattering, the symmetric and asymmetric perturbations give ifferent results both in the forward direction and at angles ther than zero. However, in the former scheme exchange cattering is negligible compared to the direct scattering. he calculations for direct scattering are shown to be simpli-ied by using a somewhat different perturbation scheme method of altered states). A.

537.533.8 : 537.534.8

7465. ON THE POLARIZATION OF BREMSSTRAHLUNG. R.Ascoli and G.Bussetti.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 147-9 (July, 1956). In Italian.

An apparent contradiction between results obtained by different methods is shown to be due to the use of different systems of reference. L.Pincherle

537.533.8

7466. ON THE STUDY OF THE BREMSSTRAHLUNG BY BLOCH AND NORDSIECK'S METHOD. R.Ascoli and G.Bussetti.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 189-96 (Aug., 1956).

The single bremsstrahlung is studied using Bloch and Nordsieck's approximation. The resulting formula is compared with that obtained by the perturbation method. The agreement of the two formulae for low energy photons is verified. The polarization of the emitted radiation is then studied using the approximate formula. In particular it is shown in a simple way that, for emission angles lying in a certain range of values, the emitted radiation is mostly polarized with its electric vector perpendicular to the emission plane, in agreement with Wick's results. Moreover it appears that, for a certain angle of emission, the low energy photons are entirely polarized with the electric vector perpendicular to the emission plane. A.

537.533.8

7467. SECONDARY ELECTRON EMISSION FROM THIN LAYERS OF Be. II. I.M.Bronshteĭn and T.A.Smorodina.
Zh. éksper. teor. Fiz., Vol. 29, No. 4(10), 495-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 410-13 (May, 1956).

For Pt I see Abstr. 7123/1955. A study was made of the change in the coefficient of secondary electron emission σ and of the energy distribution of secondary electrons, when thin layers of Be are deposited on a silver backing. It was established that, by the deposition of thin layers ($\Theta \sim 1$) of Be on Ni and Ag, the maxima of the curves of the distribution of secondary electrons from Ni and Ag are displaced in the direction of the smaller energies of the secondary electrons. A.

537.533.8 : 539.18 : 539.172

INELASTIC DIFFRACTION PROCESSES AT HIGH ENERGIES. See Abstr. 6888

537.533.9 : 537.534.9

7468. THE RADIATION OF A RAPIDLY MOVING ELECTRIC IMAGE OF A UNIFORMLY MOVING CHARGE. G.A.Askar'yan.
Zh. éksper. teor. Fiz., Vol. 29, No. 3(9), 388 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 334 (March, 1956).

The radiation caused by a charge image falling upon a conducting surface is briefly considered. R.A.Newing

537.533.9

7469. CHERENKOV RADIATION IN ANISOTROPIC FERRITES. V.E.Pafomov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 761-5 (1956). In Russian.

Emission of electromagnetic waves by a charge moving in an anisotropic ferrite with a uniform velocity exceeding the phase velocity of light is investigated. The radiation in this case differs from that in an anisotropic dielectric with respect to the distribution on the conical surface and also with respect to the energy of the radiation. A.

537.534

7470. ON THE PRODUCTION OF SLOW ELECTROMAGNETIC WAVES BY THE USE OF CYLINDRICAL CURRENT SHEETS. F.Bertein and W. Chadid.

C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2918-20 (June 18, 1956). In French.

A number of spirals wrapped on a common cylinder and of arbitrary but identical form are shown to possess advantages over a single helix for particle acceleration. A.J.Egginton

537.534 : 621.384.611

7471. THREE-PHASE RADIOFREQUENCY SYSTEM FOR THOMAS CYCLOTRONS. B.H.Smith and K.R.MacKenzie.
Rev. sci. Instrum., Vol. 27, No. 7, 485-90 (July, 1956).

As part of the programme to develop high current accelerators several model Thomas cyclotrons employing three-phase r.f. were built. The three-phase signal was produced by a phase generator which was excited by a crystal oscillator. Each phase was amplified and applied to the corresponding dee, which was kept in tune by means of servomechanisms. Balanced dee voltages require a symmetrical resonator with equal inter-dee capacitances; stability of the servomechanism requires that the effective inter-dee capacitances be zero. This last condition was fulfilled by means of neutralizing transmission lines connected from dee stem to dee stem. Thomas cyclotrons appear to be capable of producing megawatts of beam power with an r.f. efficiency in excess of 70%. A.

537.534 : 621.384.611

7472. STUDIES WITH A THREE-DEE THREE-PHASE PROTON CYCLOTRON. L.Ruby, M.Heusinkveld, M.Jakobson, B.H.Smith and B.T.Wright.
Rev. sci. Instrum., Vol. 27, No. 7, 490-3 (July, 1956).

As part of the programme to investigate the properties of the Thomas cyclotron, a 20 in. dia. proton cyclotron was constructed. In such a three-dee three-phase system it is possible to accelerate protons, deuterons, and tritons at the same setting of frequency and magnetic field but on different modes of the r.f. For stable operation in the proper mode and with balanced voltages, it has been found necessary to provide both phase servos and amplifier efficiency servos. The dees could not be servoed individually until the inter-dee capacity was neutralized. Under such conditions it was possible to attain steadily 6.0 mA of protons at 1.0 MeV in the forward mode and 6.5 mA of deuterons at 0.5 MeV in the reverse mode. A.

537.534.3

7473. CYCLOTRON INSTRUMENTATION FOR NUCLEAR SPECTROSCOPY AT MEDIUM RESOLUTION IN ENERGY. D.R.Bach, W.J.Childs, R.W.Hockney, P.V.C.Hough and W.C.Parkinson.
Rev. sci. Instrum., Vol. 27, No. 7, 516-26 (July, 1956).

The instrumentation for the magnetic focusing and analysis of the external beam of the Michigan cyclotron is described. It provides to a scattering chamber in an adjacent room a beam of deuterons of a few tenths microampere monoenergetic to within 15 keV at a mean energy of 7.8 MeV. A double-focusing analyser magnet of mean radius 1 m, focuses reaction products of magnetic rigidity less than or equal to that of a 20 MeV proton. At the optimum energy resolution of the system, proton groups from (d, p) reactions differing in Q by about 20 keV can be resolved. Particles can be observed over a continuum of angles from -7° to $+112^\circ$ relative to the incident beam. The determination of reaction energies and the measurement of relative differential cross-sections are discussed. A.

537.534.3

7474. INVESTIGATION OF THE FOCUSING PROPERTIES OF A DOUBLE DIRECTIONAL FOCUSING MAGNETIC SPECTROMETER WITH CONICAL POLE SURFACES. R.Pauli.
Ark. Fys., Vol. 10, Paper 16, 175-85 (1955).

The spectrometer uses a 180 sector field with a field distribution $H(r) = H_C(2r_C)/(r_C + r)$, where r_C is the mean orbit radius, and H_C the field at $r = r_C$. The field is obtained by conical pole surfaces with suitable spacing. Focusing is slightly astigmatic. The best position for the photographic plate was determined experimentally and agreed with calculation. The resolving power was about three times worse than the calculated value. D.R.Chick

537.534.3

7475. AUTOMATIC BEAM POSITIONING FOR MASS SPECTROMETERS. H.J.Lipkin and D.I.Porat.
Rev. sci. Instrum., Vol. 27, No. 4, 208-11 (April, 1956).

A system is described for the control of the position of the ion beam in a mass spectrometer. The instantaneous position of the beam with respect to the point of maximum collector current is presented on a cathode-ray tube indicator. The beam can be held at this maximum point either manually using this indication, or by automatic control circuits. In automatic operation the beam first "searches" for the peak by sweeping slowly across the region of the collector plate. It is then "locked in" and hunts about the point of maximum current. The amplitude of the hunting can be made sufficiently small so that the average collector current does not differ greatly from the peak current. The beam remains locked in position during slow drifts of magnet current and acceleration voltages. After large sudden fluctuations it returns to search operation and locks in shortly thereafter. The method of control is an adaptation of principles used in automatic frequency control of radar receivers. A.

537.534.3

7476. SPACE CHARGE IN CYCLOIDAL-FOCUSING MASS SPECTROMETERS. C.F.Robinson.
Rev. sci. Instrum., Vol. 27, No. 7, 512-13 (July, 1956).

In a curtate-cycloidal-focusing mass spectrometer, the first-order effect of space charge is not to impair the quality of the focus but to shift the focal point out of the plane of the resolving slit. For a given ion mass and ion current, the magnitude of the effect is about four times as large in a cycloidal-focusing instrument as in a 180° magnetic sector mass spectrometer operating in the same magnet. A.

537.534.3

7477. METHOD FOR ELIMINATING OMEGATRON RADIAL FIELD ERRORS OR FOR DIRECT MEASUREMENT OF MASS RATIOS. H.J.Woodford and J.H.Gardner.
Rev. sci. Instrum., Vol. 27, No. 6, 378-81 (June, 1956).

An omegatron having two pairs of ion-accelerating plates instead of one and using resonance absorption detection has been used successfully to obtain simultaneous cyclotron resonances of two different ion species in the same field. When used in conjunction with a nuclear resonance probe, the method effectively eliminates errors due to perturbing radial electric fields in the omegatron; alternatively, if radial electric fields are considered negligible, the method permits the direct measurement of mass ratios. A.

537.534.3 : 533.59

THE OMEGATRON AS A LEAK DETECTOR. See Abstr. 6427

537.534.74

7478. ELASTIC SCATTERING OF 18.7 MeV PROTONS BY Ni AND Cu NUCLEI. R.A.Vanetsian and E.D.Fedchenko.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 577-8 (1956). In Russian.

Measurements of the angular distributions are carried out with protons, from a linear accelerator, registered by scintillation counters. Results are compared with the curves of Woods and Saxon (Abstr. 9588/1954). G.E.Brown

537.534.75

7479. RANGE–ENERGY RELATION FOR PROTONS IN ILFORD C-2 EMULSION. J.Catalá, E.Villar, A.Bonet and L.Miralles.
An. Real Soc. Españ. Fís. Quím., Vol. 52(A), No. 3-4, 85-92 (March-April, 1956). In Spanish.

The 19 MeV deuteron beam from the Birmingham cyclotron has been used to produce protons from the C^{12} (d,p) C^{13} reaction. The measurements of proton ranges corresponding both to the C^{13} ground state and those elastically scattered by the bombarding deuterons, in Ilford C-2 dry plates, have given thirteen new points for the relation, E=f(R), between 13 and 1.5 MeV. The values of the energy, E, the range, R, and the appropriate reactions are tabulated. Considering previous results from 5.5 to 16 MeV, it is concluded that $E=0.2522\,R^{0.5833}$. This relation has been plotted and found to agree with points obtained by Rotblat and calculated by Vigneron to within 1% in energy. J.J.Phipps

537.534.75

7480. THE RANGE—ENERGY RELATION FOR PROTONS IN NUCLEAR EMULSIONS. G.Baroni, C.Castagnoli, L.Cortini, C.Franzinetti and A.Manfredini.
Ricerca sci., Vol. 26, No. 6, 1718-31 (June, 1956). In Italian.

Results are compared with the theoretical curves and the semi-empirical curves in common use. The range—energy relation was computed up to 5 GeV energies, using the Sternheimer formula, and the results are given in tables and graphs. A.

537.534.75

7481. THE ABSORPTION CROSS-SECTIONS OF 0.95 GeV PROTONS BY LIGHT AND HEAVY NUCLEI IN THE PHOTOGRAPHIC EMULSION. G.Philbert.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2547-50 (May 23, 1956). In French.

G.5 emulsions with 4 times the normal gelatine content, exposed to the 1 BeV proton beam from the Birmingham synchrotron, have been line scanned. The mean free path for interactions with light and heavy nuclei have been determined. The diffraction scattering of the protons is discussed and the results compared with those of other workers. D.J.Prowse

537.534.8

7482. EMISSION OF PHOTO RADIATIONS BY THE IMPACT OF POSITIVE IONS OF HELIUM ON NICKEL. R.F.Chaudri, M.Y.Khan and A.L.Taseer.
Nature (London), Vol. 177, 1226-7 (June 30, 1956).

A description of a direct experimental proof of the emission of radiation when a positive ion of He, neutralized by extraction of an electron from an Ni surface, reverts from the excited state to the ground state. The stream of ions impinges on the target at grazing incidence. Radiation is detected on a photomultiplier opposite the target. A.H.W.Beck

537.534.8

7483. EXCITATION OF LIGHT IN HYDROGEN AND HELIUM BY HYDROGEN IONS. E.J.Dieterich.
Phys. Rev., Vol. 103, No. 3, 632-3 (Aug. 1, 1956).

The light excited when protons or H_2^+ ions pass through hydrogen or helium with kinetic energies of 2000 eV has been observed. Contamination of the beam by stray particles has been eliminated by electrostatic deflection and magnetic mass separation. The light is almost entirely due to the Balmer spectrum. Relative cross-sections for the excitation of H_α by protons and H_2^+ impinging on H_2 and He have been determined. A.

DISCHARGE TUBES. COUNTERS 537.54

537.542 : 537.531.08

7484. GAS-FLOW PROPORTIONAL COUNTER FOR SOFT X-RAY DETECTION. C.F.Hendee, S.Fine and W.B.Brown.
Rev. sci. Instrum., Vol. 27, No. 7, 531-5 (July, 1956).

One of the major problems of analysis in the soft X-ray region is the limitation due to low transmission of the window materials of sealed-off X-ray detectors. This paper describes the properties and use of a gas-flow proportional counter system for the X-ray analysis of elements in the third period of the periodic table, with special reference to aluminium and silicon. The use of gases flowing continuously through the counter at atmospheric pressure in conjunction with helium also at atmospheric pressure in the optical path permits the use of ultra-thin nonvacuum-tight windows with high transmission in this region. Comparative data, obtained on a Norelco fluorescence spectrometer, show a tenfold increase in counting efficiency for AlK_α over detectors previously available for this application. A.

537.542 : 539.164.9

A GASEOUS SCINTILLATION DETECTOR. See Abstr. 6868

537.542 : 621.318.572

7485. NEW TIMING METHOD FOR SCINTILLATION EVENTS IN FAST COINCIDENCE EXPERIMENTS. P.Weinzierl.
Rev. sci. Instrum., Vol. 27, No. 4, 226-9 (April, 1956).

The output pulses from scintillation detectors are amplified in conventional feedback amplifiers and transformed into a bipolar wave form, which passes the discrimination level of the following EFP 60 trigger circuit at a given time after inception of the scintillation pulse, independent of its amplitude within a wide range. If these standard pulses are shaped and fed into a fast coincidence circuit, even for NaI (Tl) resolving times of the order of 10^{-8} sec can be obtained. The main limitation of the method is due to time jitter of the standard pulses caused by statistical fluctuations of the rising edge of the photomultiplier pulses which results in a reduction of coincidence efficiency. A.

537.542 : 621.318.572

7486. FAST TIMING OF SCINTILLATION PULSES. H.K.Ticho and J.Gauger.
Rev. sci. Instrum., Vol. 27, No. 6, 354-9 (June, 1956).

Some modifications of the conventional chronotron circuit are discussed. Using such a modified chronotron, time interval distributions due to two liquid scintillation counters have been studied under various experimental conditions. These studies suggest that even when counters with sensitive areas of ~ 300 cm^2 are used, a precision of ± 0.25 mμsec in an individual time interval measurement can be achieved if the distance between the particle trajectory and the photosensitive surface is known. A.

537.542

7487. A CLOUD CHAMBER ILLUMINATION UNIT. Á.Bardócz and Á.Klatsmányi.
J. sci. Instrum., Vol. 33, No. 8, 324-5 (Aug., 1956).

Gives two circuits, with a brief description, of flash tube arrangements for Wilson chamber work. J.D.Craggs

537.542

7488. INVESTIGATION OF THE FIELD OF PARTIAL PRESSURES IN A DIFFUSING CONDENSING CHAMBER. V.K.Liapidevskiĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 2(8), 263-4 (1955). In Russian. English translation in: Soviet Physics JETP (New York) Vol. 2, No. 2, 346-7 (March, 1956).

The temperature distribution inside the chamber is measured by a horizontally-placed thermocouple whose height can be altered magnetically. Knowing the degree of expansion, it is then possible to determine the partial-pressure of the vapour at the cross-section where the boundary of a dense cloud, condensed on neutral or charged centres, is located. It is shown that changing the condensation conditions over a wide range hardly affects the character of the partial-pressure distribution above the sensitive layer. D.V.Mabbs

537.543 : 621.385.2

7489. EFFECT OF THE CATHODE WORK FUNCTION ON THE SPACE-CHARGE-LIMITED CHARACTERISTICS OF PLANE DIODES. C.R.Crowell.
J. appl. Phys., Vol. 27, No. 1, 93 (Jan., 1956).

Presents a normalized current—voltage characteristic for various values of the saturation emission. This enables the work-function to be determined from measurements of the anode current taken near the saturation value. A.H.W.Beck

537.543

7490. POTENTIAL DISTRIBUTION BETWEEN PARALLEL PLANES IN ELECTRON TUBES. P.L.Copeland, L.M.Sachs and E.C.Czech.
J. appl. Phys., Vol. 27, No. 7, 816-19 (July, 1956).

In this paper, problems of space charge between parallel planes subject to conventional simplifying assumptions are solved in a way which makes it possible to calculate the potential distribution directly from information about electrode spacing, electrode potentials, and current density restricted to the range in which a stable space-charge distribution is established by a constant current density. The sources of information are (1) the application of the method of Copeland and Eggenberger to the development of the space-charge cloud as the current between parallel planes is increased from zero and (2) at currents high enough to give a potential minimum, the reduction of the problem to the easily solved case of the equivalent distribution between planes of the same potential. A.

537.543 : 537.533.3

SPACE CHARGE EFFECTS IN ELECTRON BEAMS IN KLYSTRONS. See Abstr. 6693

IONIZATION. THERMIONICS 537.56/58

537.56/.57

7491. THE ENERGY SPECTRUM OF IONIZING PARTICLES OF HIGH ENERGY AFTER PASSAGE THROUGH A THICK LAYER. Yu.F.Orlov.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 613-14 (1956). In Russian.

The form of the spectrum of a fast ionizing particle after passage through a thin layer is determined by the relationship $S = \overline{\Delta E}/\epsilon_{max}L_i$. In treating the case of a thick layer the author derives a general distribution function for a certain energy loss after passage through a layer of given thickness. This function is shown to give the Landau curve (Journal of Physics, USSR, Vol. 8, 210, 1944), for $S \ll 1$ and the Gaussian curve of Pomeranchuk (Abstr. 3804/1948) for $S \gg 1$. C.R.S.Manders

537.561

7492. MASS SPECTROMETRY OF OZONE. J.T.Herron and H.I.Schiff.
J. chem. Phys., Vol. 24, No. 6, 1266-7 (June, 1956).

Liquid ozone was collected from an ozonizer and was oxygen evacuated at −196°C. Ozone was pumped at 0.1 mm Hg at −183°C, and a constant ion current at mass 48 was obtained, no mass 64 being observed. Extrapolation of ionization efficiency curves by the voltage difference method have an ionization potential of 12.80 ± 0.05 eV for ozone. J.Jacobs

537.561

7493. IONIZATION AND DISSOCIATION BY ELECTRON IMPACT. I. TRIFLUOROMETHYL HALIDES. J.Marriott and J.D.Craggs.
J. Electronics, Vol. 1, No. 4, 405-20 (Jan., 1956).

Describes an investigation, with a mass spectrometer, of the various processes occurring in CF_3Br and CF_3I with electron impact. Negative and positive ions were studied and critical potentials for the various processes are given. Comparison is made with earlier work on CF_3Cl and CF_4. J.D.Craggs

537.562

7494. ADIABATIC PROCESSES AT HIGH TEMPERATURES. I.L.Aptekar' and B.L.Timan.
Zh. éksper. teor. Fiz., Vol. 28, No. 6, 758-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 327-9 (March, 1956).

Explicit expressions are found for the equation of state and the degree of ionization during adiabatic processes in an ionized monoatomic gas. Graphs are plotted of the pressure and degree of ionization as functions of temperature. R.O.Davies

537.563

7495. MASS SPECTROMETER STUDY OF THE VAPORS FROM RED PHOSPHORUS AND ARSENIC. J.S.Kane and J.H.Reynolds.
J. chem. Phys., Vol. 25, No. 2, 342-9 (Aug., 1956).

The subliming vapours from red phosphorus and arsenic have been subjected to electron bombardment and the mass spectra studied over a range of electron energies, orifice sizes and crucible temperatures. Detailed appearance potential curves of the monomer, dimer, trimer and tetramer ions are presented. The relative mass spectra did not change with orifice size or crucible temperature. The hypothesis of essentially complete sublimation as the tetramer is advanced and defended. Concurrent studies of the rate of sublimation under Langmuir conditions versus temperature lead to heats of activation for the sublimation process which are in satisfactory agreement with earlier weight loss studies. Influence on the mass spectrum by thermal dissociation at the mass spectrometer filament was studied by increasing the area of glowing tungsten in the ion source. Analysis of changes in the appearance potential curves so produced reveals structure in these curves not detectable directly. A search for heavy ions failed to detect P_8^+ ions in the abundance reported earlier but detected As_6^+ and As_8^+ ions with an abundance about 10^{-5} as great as As_4^+. A.

537.564

7496. TRANSFORMATION OF POSITIVE HELIUM IONS INTO NEGATIVE ONES IN COLLISIONS WITH ATOMS OF INERT GASES. V.M.Dukel'skiĭ, V.V.Afrosimov and N.V.Fedorenko.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 792-3 (1956). In Russian.

Production of negative ions for Kr, A, Ne and He is studied in the energy range 15-175 keV. G.E.Brown

537.568

7497. DEPENDENCE OF THE COEFFICIENT OF ELECTRONIC RECOMBINATION ON TEMPERATURE AND PRESSURE. I.L.Aptekar' and B.L.Timan.
Zh. tekh. Fiz., Vol. 26, No. 2, 343-7 (1956). In Russian.

The theory of the variation of ionic recombination with pressure has been developed satisfactorily for low pressures (J.J.Thomson) and for high pressures (P.Langevin). The authors examine the problem in a statistical manner and making assumptions appropriate for a gas at moderately low (room) temperatures and pressures ($p > 10^{-3}$ and up to a few atmospheres), derive an expression for the recombination coefficient. For argon at room temperature this expression gives a peak value for a pressure of about 2 atmospheres. Generally speaking the variation of the coefficient found statistically coincides with that found experimentally for ionic recombination in air. C.R.S.Manders

537.583 : 621.385.832

498. EFFECT OF CATHODE ROUGHNESS ON THE MAXIMUM CURRENT DENSITY IN AN ELECTRON BEAM. .W.Preston.
appl. Phys., Vol. 27, No. 6, 627-30 (June, 1956).

A discussion is presented of the limitation of current density by random irregularities of the cathode surface in an electron beam which is focused by a static electromagnetic field. he Langmuir-Pierce law for the maximum attainable current ensity is profoundly altered by the effects of cathode roughess. It is found that the minimum beam diameter attainable typical cathode-ray tubes is unaffected by change of cathode emperature or proportional change in the potentials of all lectrodes. A.

537.583 : 537.311.31

CONDUCTION MECHANISM IN OXIDE-COATED ATHODES. See Abstr. 6621

COSMIC RAYS 537.591

537.591

499. EXPLANATION OF THE TRANSITION EFFECT OF STARS" IN THE STRATOSPHERE. Zh.S.Takibaev. h. éksper. teor. Fiz., Vol. 30, No. 4, 713-18 (1956). In ussian.

An explanation of the transition curves for stars based on he cascade multiplication of nucleons is presented. It is hown that marked transition effects for stars should be observed at heights exceeding 15 km above sea level even when bsorbers of heavy elements are employed, a prediction which grees with the experimental data. In the case of absorbers of eavy elements the excess of neutrons over protons in the ucleus should be taken into account. A.

537.591.1

500. ON THE MEASUREMENTS OF COSMIC RADIATION N HORIZONTAL DIRECTION. M.Kogut and A.Oleś. cta phys. Polon., Vol. 14, No. 4, 369-72 (1955).

Measurements have been carried out on the intensity of osmic radiation in a horizontal direction. Unlike previous ttempts to measure this, the counter telescope was well protected by an anticoincidence set. The transition curve of the on-ionizing radiation in a horizontal direction appears to be dentical with that measured vertically but at energies of 10^8eV the excess of photons over electrons observed at lower nergies no longer appears. A.J.Egginton

537.591.1

501. ON THE ANGULAR DISTRIBUTION OF PENETRATING COSMIC-RAY PARTICLES AT A DEPTH 103 MWE BELOW GROUND. B.V.Sreekantan, S.Naranan and P.V. Tamanamurty.
Proc. Indian Acad. Sci. A, Vol. 43, No. 2, 113-29 (Feb., 1956).

The production spectrum of the parents of the underground penetrating particles has been determined from a measurement f the angular distribution of the penetrating particles at a epth of 103 mwe. The results indicate a power-law production pectrum with an exponent -1.92 ± 0.08. This production spectrum has been used to deduce the theoretical intensity-depth urves for different compositions of the parents of μ-mesons. A comparison of the theoretical curves with the composite ntensity—depth curve leads to the following conclusions: a) The experimentally determined intensity-depth curve cannot e quantitatively explained, if π-mesons produced in the nuclear nteractions of the primaries, are the only parents of μ-mesons, nd if they have the following properties: (i) the production pectrum is a power law with an exponent greater than 1.8. (ii) π-mesons decay into μ-mesons with a life-time 2.56×10^{-8} sec. (iii) π-mesons interact with the same cross-section as the primaries. (b) The production, in addition to π's of other heavy mesons, which decay into μ-mesons, will not remove the discrepancy between the observed and theoretical intensity-depth curves, unless these heavy mesons are produced in as large numbers as the π's and have a life-time for μ-decay less than 10^{-9} sec. Existing experimental evidence indicates a ratio not smaller than 3 for the ratio of production of π's to heavy mesons and a life-time of the order of 10^{-8} sec for the decay of heavy mesons into μ-mesons. Calculation shows that the discrepancy is removed to a considerable extent if about 5% of the mesons produced in nuclear interactions are μ-mesons or short-lived particles decaying into μ-mesons. At present there is no experimental evidence either in favour or against such a hypothesis. A.

537.591.1 : 532.517.4 : 538.3

THEORY OF THE ACCELERATION OF CHARGED PARTICLES BY ISOTROPIC GAS MAGNETIC TURBULENT FIELDS. See Abstr. 6796

537.591.15

7502. INVESTIGATION OF THE STRUCTURE OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. A.T.Abrosimov, A.A.Bednyakov, V.I.Zatsepin, Yu.A.Nechin, V.I.Solov'eva, G.B.Khristiansen and P.S.Chikin.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 693-6 (1955). In Russian. English translation in: Soviet Physics JETP (New York) Vol. 2, No. 2, 357-60 (March, 1956).

56 groups of 24 counters, each group containing counters of either 24 100 or 330 cm^2 area, all hodoscoped, together with 4 penetrating-particle detectors have been suitably spaced at sea level and at the Pamir (3860 m) to study the distribution of the electronic and of the nuclear interacting shower particles. The authors are satisfied that they can determine the position of the shower axis within 1 m. Results have been obtained by averaging over a number of showers in narrow size (N) intervals. At distances from the core of 2 to 10 m the spatial electron distribution can be described by $1/r^n$, where $n = 0.93 \pm 0.08$ for showers with $\bar{N} = 10^5$, $n = 1.0 \pm 0.05$ for showers with $\bar{N} = 4 \times 10^4$. Nuclear interacting particles in the interval 1.5×10^4 to 4×10^5 follow a curve $1/r^n$, with $n = 1.1 \pm 0.2$. The importance of the presence at sea level of a sharp core as well as the identity of the results obtained at sea level and at 3860 m is pointed out. E.W.Kellermann

537.591.5

7503. AN UNUSUAL SUDDEN INTENSITY INCREASE OF THE COSMIC RADIATION. R.Steinmaurer.
Naturwissenschaften, Vol. 43, No. 8, 174 (1956). In German.

Two parallel, but independently run, ionization chambers shielded on all sides by 10 cm lead have registered this effect on the Hafelekar (2300 m) on Feb. 23, 1956. The curves obtained show a sudden rise between 3.00 and 4.00 hr to at least 4 to 5 times the normal value, returning to this value later on the same day. It is pointed out that a magnetic storm did not follow this increase until Feb. 25 at 6.30. A smaller increase of the cosmic-ray intensity was registered previously on Jan. 22, 1956 between 6 and 7 hr. E.W.Kellermann

537.591.5 : 523.72

7504. COSMIC RADIATION FROM THE SUN. W.Messerschmidt.
Naturwissenschaften, Vol. 43, No. 8, 174 (1956). In German.

The meson component of the cosmic-ray intensity was measured at Halle by two ionization chambers shielded by 150 g/cm^2 lead and iron. The increase on Feb. 23, 1956 started at 3.45. An excess intensity of 130% above normal was reached a few minutes later, decreasing from 4.30 till 8.30 after hourly intervals to 11%, 4.5%, 2%, 1%, after which a constant level was reached again. E.W.Kellermann

537.591.5

7505. ON THE DAILY VARIATIONS WITH SOLAR AND SIDEREAL TIME OF EXTENSIVE AIR SHOWERS. J.Daudin, P.Auger, A.Cachon and A.Daudin.
Nuovo Cimento (Ser. 10), Vol. 3, No. 5, 1017-32 (May, 1956). In French.

These have been measured by means of a G.M. counter arrangement with separation distances of up to 80 metres at the Pic du Midi (2860 m). It is assumed that the set-up is sensitive to showers caused by primaries of 3×10^{14} to 4×10^{15} eV. Corrections for barometric pressure, local temperature, and accidental coincidences were made. Although the statistical precision of the data is admittedly unsatisfactory, the authors believe that there are sufficient grounds to think that while the air showers show no daily solar variation they do have a daily variation with sidereal time with a maximum at about 21 hours and with an amplitude of 0.08% to 0.16% for shower primaries of energy 3×10^{14} to 2×10^{15} eV.

E.W.Kellermann

537.591.5 : 523.75

7506. A SOLAR FLARE TYPE INCREASE IN COSMIC RAYS AT LOW LATITUDES. V.Sarabhai, S.F.Duggal, H.Razdan and T.S.G.Sastry.
Proc. Indian Acad. Sci. A, Vol. 43, No. 5, 309-18 (May, 1956).

During the hour following the big solar flare on 23 February 1956, an average increase of $+5.7 \pm 0.8\%$ was observed in meson intensity measured with standard telescopes at Ahmedabad, Kodiakanal and Trivandrum. This is the first report of a singificant solar flare type increase in cosmic rays near the geomagnetic equator. If the increase is due to solar protons travelling in approximately direct paths, the energy of the protons must extend from about 35-67.4 BeV. It is estimated that the average flux of such protons is approximately equal to 1.5 times the flux of general cosmic-ray intensity in the same energy range. During the hour, the sun is estimated to have emitted more than 10^{28} protons of about 50 BeV energy. A.

537.591.5 : 550.385 : 523.745

7507. CORRELATION AMONG MAGNETIC STORMS, SOLAR PHENOMENA AND COSMIC-RAY STORMS. Y.Sekido, M.Wada, I.Kondoh and K.Kawabata.
Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 174-80 (1955).

Magnetic storms are classified into S- or M-type storms according to whether or not they accompany a decrease in cosmic-ray intensity. The correlation between the occurrences of the magnetic storms and the central meridian passages of the large sunspot groups is good for the magnetic storms of type S. The correlation vanishes for the storms of type M. Like the relative sunspot numbers, the frequency of occurrence of S-type storms shows a pronounced 11-year cycle variation, while that of the M-type storms does not show such variation. The 27-day recurrence tendency of geomagnetic activity is analysed by the superposed-epoch method, where the magnetic storms of type S and M are selected as zero days. The curve around the M-type storms consists of rather sharp peaks in several cycles with flat portions in between, which is similar to a curve obtained by Chree, whereas the curve for S-type storms shows almost sinusoidal variation. It may be concluded that S-type storms are caused by the corpuscular clouds which are ejected from sunspot groups, and the M-type storms are caused by the corpuscular beam from the so-called M-regions.

A.

MAGNETISM 538

538.082 : 621.317.411

7508. A RE-ENTRANT CAVITY FOR MEASUREMENT OF COMPLEX PERMEABILITY IN THE VERY-HIGH-FREQUENCY REGION. R.D.Harrington, R.C.Powell and P.H.Haas.
J. Res. Nat. Bur. Stand., Vol. 56, No. 3, 129-34 (March, 1956).

A re-entrant cavity, constructed for measuring the initial complex permeability of magnetic toroids in the very-high-frequency region, is described. Many of the electrical and mechanical problems associated with the development of an instrument of this type are considered. The general theory of permeability measurements, using a re-entrant cavity, is discussed, and the associated working equations are derived. Calibration techniques and results of measurements on several samples are also given. A.

538.082.1

7509. BALANCE FOR MEASUREMENT OF MAGNETIZATION FROM 1.4°K TO ROOM TEMPERATURE. R.Conte.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2528-31 (May 23, 1956). In French.

A pendulum type of magnetic balance is described for measuring the magnetic moment of specimens in a field up to 17 000 G. The comparative accuracy claimed is 0.1%.

H.J.H.Starks

538.082.74

7510. DEVELOPMENT OF A VIBRATING-COIL MAGNETOMETER. D.O.Smith.
Rev. sci. Instrum., Vol. 27, No. 5, 261-8 (May, 1956).

The vibrating-coil magnetometer measures the magnetization of a small sample of magnetic material placed in an external magnetizing field by converting the dipole field of the sample into an a.c. electrical signal. To allow space for temperature- or pressure-generating apparatus around the sample, the measurement is made at distances up to 2 cm from the sample. The measurement is continuous and can be recorded on a chart as a function of time, temperature, crystallographic orientation, or magnetizing field. The present stable sensitivity is such as to provide one % accuracy for a dipole moment of 8.56×10^{-4} amp-m^2 (the saturation moment at room temperature of a nickel sphere 1.5 mm in diameter). A.

538.114

7511. ON THE INFLUENCE OF DISLOCATIONS ON THE COERCIVE FORCE OF FERROMAGNETICS. F.Vicena.
Czech. J. Phys., Vol. 5, No. 4, 480-501 (Dec., 1955). In Russian with summary ($1\frac{1}{2}$ pp) in English.

In two previous papers (Abstr. 4778/1955, 4806/1955), the dependence of coercive force for two types of internal stress distribution was investigated. In the present paper a study is made of the influence of elastic fields around dislocations on the motion of Bloch walls and thus on the coercive force. The results of the paper may be summed up as follows: (1) It is shown that dislocations represent an imperfection of the crystal which influences the displacement of Bloch walls between regions of spontaneous magnetization in a ferromagnetic. The contribution of the dislocations to the coercive force compared to other factors (e.g. inclusions) may be so great that it cannot be overlooked. (2) From the results of the considerations on the contribution of dislocations in unworked and strongly worked materials to the coercive force, it can be inferred that the existing phenomenological stress theory of coercive force can be replaced by a dislocation theory of the coercive force. (3) It was shown that the coercive force also depends on the parameters of the mosaic structure. The contribution of this factor to the coercive force, as determined in this paper, is uncertain due to the as yet insufficient knowledge on the mosaic structure of ferromagnetics. (4) It was possible, with very good order-of-magnitude agreement, to explain the influence of plastic deformations on the coercive force on the basis of dislocations.

A.

538.114

7512. THE GROUND STATE OF ANTIFERROMAGNETICS AS OBTAINED BY THE METHOD OF ELEMENTARY EXCITATIONS. S.V.Tyablikov and A.Ts.Amatuni.

kl. Akad. Nauk SSSR, Vol. 108, No. 1, 69-72 (1956). In ıssian.

It is assumed that antiferromagnetic lattices consist of yers; magnetic moments of the ions in a layer are supposed be parallel to each other and antiparallel to the moments in ljacent layers. The energy is obtained as a function of the :ternal field strength and the electronic spin operators, exıange integrals playing the part of parameters. The minimum energy is derived and interpreted as the energy of the ground ate. In this deduction the spin operators are, by the way of method of approximation, replaced by classical variables. ıe resulting magnetization curve is compared with experiental data for single crystals of the chloride of monovalent ›pper. R.Eisenschitz

538.114

513. NEW MAGNETIC ANISOTROPY. W.H.Meiklejohn ıd C.P.Bean.
hys. Rev., Vol. 102, No. 5, 1413-14 (June 1, 1956).

The new anisotropy is described as being the result of an ıteraction between the spins of an antiferromagnetic material ıd a ferromagnetic material, and has been observed in fine articles of cobalt with a cobaltous oxide shell. This material, hen cooled through the Néel temperature in a saturating magetic field, possesses only one easy direction of magnetizaon. The coercive force and the remanent induction become symmetrical along the axis of magnetization, and the materıl exhibits a rotational hysteresis that is independent of the eld at high fields. An anisotropy constant of 5×10^6 ergs/cm^3 as been calculated from the torque curve. A.E.De Barr

538.12.08

514. VIBRATING PERMALLOY PROBE FOR MAPPING IAGNETIC FIELDS. J.Kaczér and R.Gemperle.
zech J. Phys., Vol. 6, No. 2, 173-84 (April, 1956).

A detailed description is given of the apparatus for mapping ıe magnetic field on the surface of ferromagnetic materials. ›me of its properties are shown by a calibration equipment sed. Examples are given of the application of the probe in ıapping the domain structure of silicon iron. A.

538.122

515. DIFFUSION AND SEVERING OF MAGNETIC LINES F FORCE. E.N.Parker and M.Krook.
strophys. J., Vol. 124, No. 1, 214-31 (July, 1956).

The general asymptotic form for the magnetic field in a iffusing flux tube is developed and applied to the problem of evering magnetic lines of force in a medium with finite elecrical conductivity. Calculations of the details of the severing nd reconnection of lines of force are given for the formation f an idealized free meridional magnetic ring in a hydromagetic dynamo, for the merging of idealized neighbouring rings, nd for the straightening of the lines in a twisted tube, in order › illustrate the general qualitative features of these processes s they would presumably occur in the core of the earth. The roblem of two nearly intersecting slender flux tubes is conidered in order to demonstrate how the lines of force of the esser tube are diverted into the denser tube. A.

538.122

516. MEASUREMENT OF GRADIENTS OF INHOMOENEOUS MAGNETIC FIELDS. S.B.Karmohapatro and .K.Majumder.
ci. and Culture, Vol. 21, No. 10, 621-2 (April, 1956).

The gradient is measured in terms of the output from a earch coil, vibrated at 100 c/s by an a.c. excited relay. The ield gradient of a conical magnet for mass spectrometry ould be determined with an accuracy of 2.5%. E.A.Ash

538.213 : 537.226.2 : 621.318.1 : 621.315.611

DIELECTRIC CONSTANT AND PERMEABILITY OF ARTIFICIAL DIELECTRICS AT 3 cm WAVELENGTH. See Abstr. 6595

538.22

7517. NOTE ON THE MAGNETIC ANISOTROPY OF THE COBALT AMMONIUM TUTTON SALT $CO(NH_4)_2(SO_4)_2 \cdot 6H_2O$. N.Uryû.
J. Phys. Soc. Japan, Vol. 11, No. 7, 770-4 (July, 1956).

Magnetic anisotropy of cobalt ammonium Tutton salt in the temperature region from about 10°K to 300° K is studied, using the wave functions obtained by Abragam and Pryce. The temperature dependence of the effective Bohr magneton is also studied. The agreements of the present theoretical results with the experimental ones are excellent. A.

538.22 : 536.48

7518. MAGNETIC PROPERTIES OF SOME ORTHOFERRITES AND CYANIDES AT LOW TEMPERATURES. R.M.Bozorth, H.J.Williams and D.E.Walsh.
Phys. Rev., Vol. 103, No. 3, 572-8 (Aug. 1, 1956).

The magnetization of some rare-earth orthoferrites and related compounds, and of some iron-group cyanides, has been investigated at temperatures between room temperature and 1.3°K. Some are ferromagnetic, some antiferromagnetic, and some paramagnetic following the Curie–Weiss law. The compounds $GdVO_3$, $GdFeO_3$ and $ErFeO_3$ are apparently antiferromagnetic with Néel points of 7.5°, 2.5° and 4.5°K, respectively. Ordering of the Gd and Er ions at low temperatures is indicated. The compounds $NdFeO_3$, $SmFeO_3$, $YFeO_3$, $NdVO_3$, $PrVO_3$ and $SmVO_3$ show a rapid rise in ferromagnetic moment as the temperature is lowered below about 15°K. $GdTiO_3$ is ferromagnetic with 0.54 Bohr magneton per molecule. Many of the cyanides of type $A(BC_6N_6)$ are ferromagnetic with magnetic moments of 1 to 4 Bohr magnetons per molecule and Curie points of 3 to 50°K. A null method of measurement is used. Movement of a pendulum in a field gradient is detected with strain gauges and balanced with a coil. In the space containing the specimen and the balancing coil the gradient varies linearly with distance. A.

538.22.08

7519. A NEW METHOD FOR MEASURING THE SUSCEPTIBILITY OF PARAMAGNETIC AND DIAMAGNETIC SUBSTANCES. F.Vilím.
Czech. J. Phys., Vol. 6, No. 1, 84-90 (Jan., 1956).

The paper deals with a number of methods for measuring the susceptibility of paramagnetic and diamagnetic substances mentioning their disadvantages. The principle of a new method for measuring susceptibility is given and the instrument described. The satisfactory operation of the instrument is demonstrated on several examples of measurement. A.

538.221

7520. MAGNETIC PROPERTIES OF YTTRIUM FERRITE $5\,Fe_2O_3.3\,Y_2O_3$ (GARNET). R.Aléonard, J.C.Barbier and R.Pauthenet.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2531-3 (May 23, 1956). In French.

Reports results of measurements of the spontaneous magnetization and susceptibility between 4° and 1500°K. The Curie temperature is 560°K, the saturation magnetization 9.44 μ_B and the inverse susceptibility–temperature curve hyperbolic, appropriate to a ferrimagnetic substance.

E.P.Wohlfarth

538.221

7521. EFFECT OF MAGNETOSTRICTION ON THE INITIAL PERMEABILITY OF MANGANESE–ZINC FERRITES. R.Vautier.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2814-17 (June 11, 1956). In French.

Reports results of measurements of the initial permeabilities μ and magnetostriction coefficients λ of a number of polycrystalline mixed Mn–Zn ferrite specimens which have been heat treated by different amounts. It is found that μ has a minimum value about 1500 when $\lambda = 0$, contrary to expectation. Measurements were also made for samples with different MnO

contents; no simple correlation between μ and λ was established.
E.P.Wohlfarth

538.221

7522. EFFECT OF Al^{3+} IONS SUBSTITUTED FOR Fe^{3+} IONS ON THE MAGNETIC PROPERTIES OF THE COMPOUNDS $6Fe_2O_3 . BaO$, $6Fe_2O_3 . SrO$ AND $6Fe_2O_3 . PbO$. C.Guillaud and G.Villers.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2817-20 (June 11, 1956). In French.

For the Al free compounds the coercive force H_C varies roughly hyperbolically with the grain size, reaching 3200 oersted at 1 μ. Replacing Fe_2O_3 by 15% Al_2O_3 decreases the grain size and increases H_C, 10 000 oersted at about 0.3 μ, in agreement with the calculated value for crystalline anisotropy controlled single domains. The saturation magnetization was found to decrease linearly on increasing the Al_2O_3 content. The magnetization, coercive force and remanence were also measured as function of field, and an anomalous inflection was observed and believed to be due to a partial antiferromagnetic contribution to the total magnetization at fields below about 4500 oersted.
E.P.Wohlfarth

538.221 : 548.7

7523. THE DOMAIN STRUCTURE IN POLYCRYSTALLINE IRON. L.Špaček.
Czech. J. Phys., Vol. 5, No. 4, 553-4 (Dec., 1955).

Theoretical interpretation of the three types observed.
J.Adam

538.221

7524. MAGNETIC DISPERSION AND ABSORPTION OF IRON BETWEEN 0 AND 7 kMc/s. E.Naschke.
J. Phys. Radium, Vol. 17, No. 4, 330-7 (April, 1956). In French.

Reports results of measurements of the complex permeability of iron specimens heat treated at temperatures between 500° and 1220°C, and obtains agreement with the theoretical results of Néel (Abstr. 3652/1954). The domain widths deduced are in good agreement with powder pattern values.
E.P.Wohlfarth

538.221

7525. ON THE INTERPRETATION OF MAGNETIC TORQUE REVERSAL. S.Chikazumi.
J. Phys. Soc. Japan, Vol. 11, No. 6, 718-19 (June, 1956).

Interprets the change of sign of the torque of Fe_2NiAl at high fields (Abstr. 9385/1954) not as due to the preferential growth of acicular precipitates but rather as a direct result of the magnetic annealing treatment, which induces an additional uniaxial anisotropy.
E.P.Wohlfarth

538.221 : 548.74

7526. NEUTRON DIFFRACTION STUDIES ON IRON AT HIGH TEMPERATURES. M.K.Wilkinson and C.G.Shull.
Phys. Rev., Vol. 103, No. 3, 516-24 (Aug. 1, 1956).

Measurements have been made at a series of elevated temperatures up to about 1000°C to establish the magnetic scattering effects through the Curie temperature and in the γ-phase region. Diffraction patterns obtained for the face-centred cubic γ phase offer no evidence for an antiferromagnetic structure in γ iron at high temperatures, and the diffuse scattering above T_C suggests that both phases of the metallic lattice are paramagnetic in that temperature region. At temperatures up to the α-γ phase transformation, the paramagnetic scattering suggests the existence of considerable ferromagnetic short range order. Pronounced small-angle scattering was found to develop in the temperature region around the Curie transition, and this type of scattering is explained on the basis of the critical magnetic scattering suggested by Van Hove. Detailed investigations, which included experiments on nickel and magnetite near their Curie transitions, were performed to determine the general characteristics of the critical magnetic scattering.
A.

538.221 : 548.74

7527. CRITICAL MAGNETIC SCATTERING OF NEUTRONS BY IRON. H.A.Gersch, C.G.Shull and M.K.Wilkinson.
Phys. Rev., Vol. 103, No. 3, 525-34 (Aug. 1, 1956).

The experimental results (preceding abstract) for the small-angle scattering of 0.9 A neutrons from iron at temperatures close to the Curie point are analysed in terms of the instantaneous correlation between pairs of spins of the iron atoms. Fourier inversion of the angular distribution of the scattering gives the spatial dependence of the spin-spin correl ations, while their temperature dependence follows from the temperature variation of the angular distributions. The correl ation functions so obtained are compared with the asymptotic form predicted by statistical mechanics and show consistency with the measured values of the paramagnetic susceptibility fo iron above the Curie temperature.
A.

538.221

7528. CATION DISTRIBUTIONS IN FERROSPINELS. THEORETICAL.
H.B.Callen, S.E.Harrison and C.J.Kriessman.
Phys. Rev., Vol. 103, No. 4, 851-6 (Aug. 15, 1956).

The statistical thermodynamics underlying the distributio of cations over the tetrahedral and octahedral sites in ferrospinels is developed. The temperature dependence of the distribution law is analysed by invoking the Debye approximation for the vibrational spectrum. The resultant equations permit the internal energy terms of interest to be deduced from measurements of magnetic moment and specific heats of various quenched samples.
A.

538.221

7529. CATION DISTRIBUTIONS IN FERROSPINELS. MAGNESIUM–MANGANESE FERRITES. C.J.Kriessman and S.E.Harrison.
Phys. Rev., Vol. 103, No. 4, 857-60 (Aug. 15, 1956).

The saturation magnetization as a function of quench temperature is measured for the ferrite system $Mg_yMn_{1-y}Fe_2O_4$. From these data the ionic distribution Mg ions is evaluated and compared to the theoretical thermodynamic analysis developed in the preceding paper (preceding abstract). The interesting quantity $\partial u_1/\partial \eta$, where u_1 is the nonthermal energy and η is the fraction of Mg ions on A sites, can be evaluate from the data only if the variation of the Debye temperature with η can be neglected. If this assumption is made, then it is found that $\partial u_1/\partial \eta$ is linearly dependent on η. The lattice constant has also been determined as a function of quench temper ature.
A

538.221

7530. MAGNETIC COMPOUNDS WITH PEROVSKITE STRUCTURE. IV. CONDUCTING AND NON-CONDUCTING COMPOUNDS. G.H.Jonker.
Physica, Vol. 22, No. 8, 707-22 (Aug., 1956).

For Pt III, see Abstr. 6938 (1953). An experimental study of the magnetic interactions in compounds with perovskite structure is given. $LaMnO_3$ is an antiferromagnetic compound, but it is shown that it would be ferromagnetic if the cubic perovskite structure, present at high temperatures, could be preserved at low temperature. Besides the positive magnetic interaction between Mn^{3+} and Mn^{4+} ions an interaction of the same sign is found between Mn^{3+} and Cr^{3+} ions. A survey is given of the results of this and former investigations.
A.

538.221 : 539.27

7531. A STUDY OF BITTER FIGURES USING THE ELECTRON MICROSCOPE. D.J.Craik.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 647-50 (June, 1956).

The Bitter figure technique is modified to give patterns in the form of thin films which can be removed from the speci men and examined by high power phase-contrast microscopy and by electron microscopy. This makes possible the observ

tion of extremely fine detail and direct measurement of the idth of domain walls. A.

538.221 : 539.234 : 537.312

MEASUREMENTS ON THE MAGNETIC PROPERTIES OF HIN FILMS AT LOW TEMPERATURES. See Abstr. 6645

538.222 : 541.67

532. INFLUENCE OF MOLECULAR STRUCTURE ON ARAMAGNETIC RESONANCE LINE WIDTHS. R.I.Walter, .S.Codrington, A.F.D'Adamo, Jr and J.C.Torrey. . chem. Phys., Vol. 25, No. 2, 319-24 (Aug., 1956).

Paramagnetic resonance absorption has been observed in series of free radical triarylaminium salts and in a series f substituted 1-picryl-2, 2-diarylhydrazyls. Within each eries, the members differ from each other only in the substituents placed in certain aromatic ring positions in the molecules. Line-width measurements in fields of 3080 and 2 oersteds are reported for powder samples of these radicals, together with "g" values measured in the larger field. A correlation has been established between the line widths of the paramagnetic resonance absorption lines of the radicals and the Hammett sigma values of their substituent groups. In general, the line widths for both series of radicals decreased with increasingly negative values of the Hammett sigma constants of the substituents. Few compounds containing substituents with positive sigma constants have been observed. Relationships between sigma and line widths for this range of sigma values have been proposed on the basis of the expected electronic effects of such substituents and are consistent with the available data except for halogen-substituted compounds. These results are interpreted in terms of the degree of delocalization of the unpaired electrons in the various free radicals studied. The effect of delocalization upon the exchange interaction of the unpaired electrons is also discussed in the light of the theories of exchange narrowing of paramagnetic resonance absorption lines. A.

538.222

7533. PARAMAGNETIC RELAXATION IN SOME COBALTOUS SALTS IN THE LIQUID HELIUM TEMPERATURE REGION. T.Haseda and E.Kanda.
Physica, Vol. 22, No. 8, 647-8 (Aug., 1956).

Reports results of measurements of the spin–lattice relaxation time of $Co(NH_4)_2(SO_4)_2 . 6H_2O$, $CoK_2(SO_4)_2 . 6H_2O$ and $CoSO_4 . 7H_2O$ as dependent on temperature and field strength. E.P.Wohlfarth

538.222 : 535.34.07

A DOUBLE MAGNETIC FIELD MODULATION PARAMAGNETIC RESONANCE SPECTROMETER. See Abstr. 6517

538.24 : 621.318.2

7534. ON THE DEFINITION AND DETERMINATION OF THE COERCIVE FORCE OF PERMANENT MAGNETS TAKING INTO ACCOUNT IRREVERSIBLE AFTER-EFFECT PHENOMENA. A.Kussman and O.Yamada.
Arch. Elektrotech (Berlin), Vol. 42, No. 4, 237-44 (1956). In German.

It is shown, experimentally and theoretically, that because of the existence of irreversible (Jordan) after-effect the measured coercive force of ferromagnetic materials is not a constant but depends upon the duration of the applied field. The variations may amount to several percent, vary logarithmically with time, and are independent of the demagnetization factor. Attention is drawn to the need to take this effect into account in defining coercive force, and in the measurement of B–H relations. A.E.De Barr

538.24

7535. THE REPRESENTATION OF MAGNETIZATION CURVES BY SIMPLE ALGEBRAIC OR TRANSCENDENTAL FUNCTIONS. J.Fischer and H.Moser.
Arch. Elektrotech. (Berlin), Vol. 42, No. 5, 286-99 (1956). In German.

Discusses the problems involved in the use of simple functions to represent magnetization curves and gives examples of their application. Criteria for testing the goodness of fit are developed and then examples of suitable functions to represent the initial region of the curve, the approach to saturation, or the whole curve are given. A table of 15 simple functions is given. A.E.De Barr

538.24

7536. THE CURVATURE OF THE BLOCH WALL AS AN ELEMENTARY PROCESS OF REVERSIBLE MAGNETIZATION CHANGES (INITIAL PERMEABILITY AND ΔE-EFFECT). M.Kersten.
Z. angew. Phys., Vol. 8, No. 7, 313-22 (1956). In German.

Discusses the effects of reversible distortions of 90° domain boundaries on the temperature variation of the initial permeability and ΔE of nickel and Fe–Ni alloys. E.P.Wohlfarth

538.24

7537. THE INTERPRETATION OF THE TEMPERATURE VARIATION OF THE INITIAL PERMEABILITY OF Mn_2Sb, COBALT, IRON AND NICKEL. M.Kersten.
Z. angew. Phys., Vol. 8, No. 8, 382-6 (1956). In German.

An extension of the discussion of the preceding abstract. The temperature variation of the domain size is also considered. E.P.Wohlfarth

538.242

7538. GYROMAGNETIC RATIOS OF THE IRON-NICKEL ALLOYS. G.G.Scott.
Phys. Rev., Vol. 103, No. 3, 561-3 (Aug. 1, 1956).

Measurements by magneto-mechanical experiments show that the gyromagnetic ratios for the alloys of the iron–nickel series undergo changes for low values of the induced magnetic intensity. This leads to a high- and a low-intensity value for g' for each metal. Two distinct curves of g' v. % nickel are thus obtained. Nine different rods were used in which the content of nickel in iron varied from 0% Ni to 100% Ni. A.

538.244.2 : 621.318.3

7539. FIELD STABILIZATION FOR LOW-OHM ELECTROMAGNETS. F.Kneubühl and K.A.Müller.
Helv. phys. Acta, Vol. 28, No. 5-6, 448-50 (1955). In German.

A rotating shaft carries opposed coils one of which is in a permanent magnet and the other in the electromagnet. The out-of-balance voltage, after phase discrimination, is amplified and fed back to the field coils of the generator thus stabilizing the electromagnet to 1/10%. D.H.Whiffen

ELECTROMAGNETISM. ELECTRODYNAMICS 538.3/.5

538.3 : 532.5

7540. EFFECT OF INTERNAL MOTIONS ON THE DECAY OF A MAGNETIC FIELD IN A FLUID CONDUCTOR. S.Chandrasekhar.
Astrophys. J., Vol. 124, No. 1, 244-65 (July, 1956).

The decay is considered in case the magnetic and velocity fields have symmetry about an axis. The underlying characteristic value problems are solved for certain simple velocity fields. The method of solution is based on a new classification of the basic axisymmetric modes of the magnetic field in terms of Gegenbauer polynomials. The principal conclusion of the paper is that velocity fields of reasonable patterns and magnitudes can alter the time of decay that will obtain in the absence of motions by quite large factors. The bearing of this result on the problem of the origin of the earth's magnetic field is briefly discussed. Certain other related questions are also considered. A.

PA

538.3

7541. ELECTROMAGNETIC FIELD SOLUTIONS FOR ROTATIONAL COORDINATE SYSTEMS. R.C.Hansen.
Canad. J. Phys., Vol. 34, No. 8, 893-5 (Aug., 1956).

Using the vector potential method of separation, the rotationally symmetric solutions of the equation curl curl $\vec{E} = k^2 \vec{E}$ are written as curls of the corresponding scalar wave function times a ϕ unit vector. This applies to (circular) cylindrical, spherical, prolate and oblate spheroidal, and (rotational) parabolic coordinates. L.Pincherle

538.3 : 532.5

7542. FLUID SELF-EXCITED DYNAMO. L.Davis, Jr.
Phys. Rev., Vol. 102, No. 4, 939-40 (May 15, 1956).

The possibility that a simply-connected perfectly conducting fluid body could generate an increasing external magnetic field by acting as a self-excited dynamo is demonstrated by exhibiting a cycle of motions that doubles the external field each cycle. The essential feature of the motion is that interior points become surface points. This requires points which were originally adjacent to become widely separated. It is argued that in the presence of a magnetic field such motions should occur. A.

538.311

7543. REPRESENTATION OF THE MAGNETIC FIELD OF CIRCULAR CURRENTS BY SPHEROIDAL FUNCTIONS. S.I.Kurenev.
Elektrichestvo, 1956, No. 6, 9-10. In Russian.

A representation of the magnetic field of circular currents by spheroidal functions is required in problems such as the magnetization of an ellipsoid of revolution by the field of a circular current or, e.g., for calculating an ellipsoidal magnetic screen for a circular current. The paper presents an expression for the scalar potential of the magnetic field of a circular arrangement through which d.c. passes. The brief and straightforward account is supplemented by a numerical example on the mutual inductance of two flat circular circuits (approximation). B.F.Kraus

538.52

7544. SHIELDING OF A TRANSIENT ELECTROMAGNETIC DIPOLE FIELD BY A CONDUCTIVE SHEET. J.R.Wait.
Canad. J. Phys., Vol. 34, No. 8, 890-3 (Aug., 1956).

A previous study (Abstr. 4045/1952, 5810/1954) for an arbitrarily oriented magnetic dipole with a moment varying harmonically with time is extended to the transient case. The magnetic field of a small wire loop with a step function excitation of current can be expressed in a simple closed form both above and below the conducting sheet. L.Pincherle

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56 : 535.11 : 536.33 : 534.23

RADIATION FROM A SPHERE IN THE PRESENCE OF SELF-ABSORPTION. See Abstr. 6455

538.561

7545. ON THE DIPOLE RESONANT MODE OF AN IONIZED GAS COLUMN. G.H.Keitel.
Austral. J. Phys., Vol. 9, No. 1, 144-7 (March, 1956).

Makinson and Slade (Abstr. 9400/1954) gave the theory of the scattering of a transverse-electric e.m. wave by an ionized gas column by assuming that the radial ion density could be represented by a step function. They found then a multiplicity of resonant dipole modes. It is suggested in the present paper that the multiple resonances were created by the infinite gradients of electron density at the steps. If a Gaussian distribution of density is assumed, only one resonance is found. L.Pincherle

538.561 : 539.152 : 621.373.42.029.6

7546. THE USE OF ELECTRON SPIN RESONANCE TO REALISE A VERY-HIGH-FREQUENCY OSCILLATOR OR AMPLIFIER. J.Combrisson, A.Honig and C.H.Townes.
C.R. Acad. Sci. (Paris), Vol. 242, No. 20, 2451-3 (May 14, 1956). In French.

Discusses the use of induced emission in an electron resonance spectrum to produce a microwave oscillator or amplifier in a manner similar to the "Maser". In an experiment with Si containing 0.6×10^{17} P atoms/cm^3 at 2°K in a cavity with $Q = 10\,000$ at 9000 Mc/s and passage through resonance in 10^{-2} sec, the ratio of the power furnished by electron emission to that required to excite the cavity was 1/3. Improvement of experimental details would be required to produce free oscillations. D.H.Whiffen

538.561 : 621.372.8

7547. GENERATION OF SUBMILLIMETER WAVES. H.Motz and K.B.Mallory.
J. appl. Phys., Vol. 26, No. 11, 1384 (Nov., 1955).

A highly-bunched 2 MeV electron beam from a linear accelerator was passed through a simple K-band waveguide. Radiation emerging from the guide was analysed by an echelette spectrometer. Wavelengths down to 0.16 mm, corresponding to very high harmonics of the operating wavelength (10.6 cm) of the accelerator, were detected. H.Motz

538.561 : 621.372.8

7548. HARMODOTRON — A BEAM HARMONIC, HIGHER ORDER MODE DEVICE FOR PRODUCING MILLIMETER AND SUBMILLLIMETER WAVES. P.D.Coleman and M.D.Sirkis.
J. appl. Phys., Vol. 26, No. 11, 1385-6 (Nov., 1955).

Millimetre waves in the 7-11 mm range have been obtained by harmonic extraction from a bunched 1.0-1.5 MeV electron beam. The 5 mA pulsed beam was produced by a 20 kV gun followed by a prebuncher cavity and an accelerating cavity. The beam was passed through a cavity which could be tuned to the 10-14th harmonic of the accelerator frequency (2775 Mc/s). At 8.1 mm one watt of peak power was obtained in agreement with a theoretical estimate. H.Motz

538.561

7549. THEORY OF PLASMA RESONANCE. P.W.Wolff.
Phys. Rev., Vol. 103, No. 4, 845-50 (Aug. 15, 1956).

Starting from the Boltzmann transport equation, a formula is derived for the rate of change of electron density in a gas plasma. With its aid a study is made of the oscillations of electron density (about the steady state value) in a discharge confined between parallel plates. The oscillations are described in terms of a set of normal modes characteristic of the plasma under study. An expression is obtained for the impedance of the discharge as a function of frequency: for the one case calculated in detail, this formula gives a resonance in power absorption at a frequency of 0.7 of the plasma resonance frequency corresponding to the central electron density. A.

538.561 : 539.13

MOLECULAR RINGING. See Abstr. 6818

538.565 : 621.372.413

7550. CALCULATION OF THE NATURAL FREQUENCY OF A π-SHAPED CAVITY RESONATOR PARTLY FILLED WITH ABSORBING MATERIAL. V.L.Patrushev.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 3, 409-12 (1956). In Russian.

The dielectric in the cavity was cone-shaped and had a complex dielectric permeability of the form

$$\epsilon = \epsilon' + j\epsilon'' = \epsilon' + j.4\pi\sigma\omega.$$

Using the formulae obtained it is possible to calculate the values of ϵ', σ, the attenuation and the natural frequency of the cavity. Z.F.Wojnar

538.566

7551. ON THE PROPAGATION OF A PRINCIPAL WAVE BETWEEN PARALLEL SURFACES. É.Burshteĭn and L.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 101, No. 3, 465-8 (1955). In Russian.

The waves are electromagnetic and the surfaces are curved. It is shown that if the distance d between the surfaces is small, the local wave-number differs from the free space wave-number by a term proportional to d^2. The coefficient of the term is calculated in terms of the curvatures of the surface. The deviation of rays from the geodesics of the curved surface is calculated in the first order.

Mathematical Reviews

538.566 : 621.372.09

7552. THE THEORY OF SPIRAL LINES. S.Kh.Kogan.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 4, 541-4 (1956). In Russian.

The problem of propagation of electromagnetic waves along a spiral line has, so far, been considered on the assumption that in a spiral there exist only longitudinal currents flowing in the direction of the wire. The assumption that the transverse currents are negligibly small is correct only for a spiral made up of a thin conductor or a narrow metal ribbon. Similar assumptions regarding the existence of the transverse component only of the electric field in the gap correspond to the case of a slotted spiral line. For the purpose of a more general solution account is taken of both orthogonal components of the current and of the field. It is shown that the dispersion in the slotted spiral line is characterized by the same features as those existing in the wire spiral. Z.F.Wojnar

538.566 : 621.372.8

7553. SURFACE CURRENTS AND WAVE GUIDES WITH FINITE CONDUCTIVITY. P.Baudoux.
Rev. H.F., Vol. 3, No. 1, 17-26 (1955). In French.

Magnetic boundary conditions are formulated in terms of a surface current density, the resulting expressions being used as the basis for determination of the propagation constants of some lower modes of parallel plate, and circular section guides with finite conductivity. G.D.Sims

538.566 : 621.396.677.09

7554. CROSS SECTION OF COLINEAR ARRAYS AT NORMAL INCIDENCE. J.M.Minkowski and E.S.Cassedy.
J. appl. Phys., Vol. 27, No. 4, 313-18 (April, 1956).

The backscattering cross-section of colinear arrays of thin dipoles at normal incidence has been derived using the variational method. It was found advantageous to use the variational principle in its scale-dependent form, since the extremum of the variational functional does not depend on the scales of the currents. The special case of the two dipole array is computed using the derived formula. The interaction integral of two dipoles is integrated giving a result in closed form. In spite of the crudeness of the trial functions used, the results appear in good agreement with the experimental data. These were taken on a Doppler modulated synchronous detection system at 3000 Mc/s. A.

538.566

7555. A THEORY OF THE DIFFRACTION OF AN ELECTROMAGNETIC WAVE BY A PLANE SCREEN. J.Pachner.
Czech. J. Phys., Vol. 6, No. 1, 8-12 (Jan., 1956).

The problem of the diffraction of an arbitrarily polarized electromagnetic plane wave by a perfectly conducting plane screen of infinitesimal thickness is reduced to scalar problems by the method known from earlier papers. The wave field diffracted either by a screen of infinite extent which is perforated by an aperture of arbitrary size and shape or by a complementary screen is then described by means of the bra-vectors, ket-vectors and linear operators introduced by the present author in one of his preceding papers. A.

538.566 : 621.396.11

7556. THE DIFFRACTION OF AN ELECTROMAGNETIC WAVE BY A CIRCULAR APERTURE. R.F.Millar.
Proc. Instn Elect. Engrs, Monogr. No. 196 R, publ. Sept., 1956, 9 pp. To be republished in Part C.

The effects of interaction across a circular aperture in a plane, perfectly conducting screen are studied by application of the approximate edge-current diffraction theory previously developed (Abstr. 507/1956), the interaction terms being found by asymptotic evaluation of the first-order aperture field. Their effect is examined by computing the aperture and axial fields and comparing the results with exact theory. An interaction correction to the geometrical-optics transmission coefficient, which agrees well with rigorous theory except for a monotonic component, is obtained. With an assumed current distribution over the entire screen, an expression is found for the transmission coefficient, neglecting interaction, which exhibits monotonic behaviour at variance with that expected from exact theory. A term with the desired variation is derived empirically. The possibility of extending the method to apertures of more general form is briefly mentioned. A.

538.566

7557. DIFFRACTION PATTERN IN THE PLANE OF A HALF-SCREEN. L.R.Lewis.
J. appl. Phys., Vol. 27, No. 7, 837-8 (July, 1956).

The diffraction pattern has been measured in the plane of, and up to 5 λ from, a conducting half-plane. Measurements were made at 5.4 and 14.1 cm. The measured pattern is consistent with an empirical expression based on Young's theory of diffraction. A comparison is made of this and previous attempts to map the diffraction pattern. W.T.Blackband

538.566

7558. DIFFRACTION BY A WIDE SLIT. S.N.Karp and A.Russek.
J. appl. Phys., Vol. 27, No. 8, 886-94 (Aug., 1956).

The problem of diffraction of scalar waves by an infinite conducting plane with a slit is investigated. Approximate expressions for the near and far fields, taking into account the interaction between the edges, are derived in terms of the well-known solutions for the field produced when an isolated conducting half-plane is excited by (a) a plane wave, and (b) a line source. Results of numerical calculation are given for the case of a plane wave normally incident on the slit. Twelve values of slit width ranging from 0.96 to 2.5 wavelengths are considered. A comparison of transmission coefficients is given. It is found that the new approximate solution agrees well with the exact solution, and provides a significant correction to the noninteraction solution. The accuracy increases with the slit width, so that the result is useful in the range where interaction cannot well be neglected but where the exact solution converges so slowly that computation is impracticable. A.

538.566.2

7559. ELECTROMAGNETIC PROPERTIES OF A FINELY STRATIFIED MEDIUM. S.M.Rytov.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 605-16 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 466-75 (May, 1956).

Media composed of alternate layers of two isotropic materials, when the layers are sufficiently thin, behave with respect to an electromagnetic field as if they were homogeneous but anisotropic (uniaxial crystal). The effective permittivity and permeability tensors ϵ and μ of such a crystal are obtained, and limiting values are derived for thin layers as functions of the parameters of their materials, and of the frequency. Losses in a finely stratified medium are considered, and also the boundary conditions at its surface. A.

538.566.3

7560. THE INTERACTION OF EXTRAORDINARY AND ORDINARY WAVES IN THE IONOSPHERE AND THE EFFECT

OF MULTIPLICATION OF REFLECTED SIGNALS.
N.G.Denisov.
Zh. éksper. teor. Fiz., Vol. 29, No.3(9), 380-1 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 342-4 (March, 1956).

Consideration of the propagation of e.m. waves in a plane, stratified ionized medium (such as the ionosphere) located in a magnetic field. During the propagation of waves of one type (o- or x-) in an inhomogeneous medium, waves of another type appear. Some examples of this interaction are considered.
G.M.Brown

538.567 : 535.56

7561. ROTATION OF THE PLANE OF POLARIZATION IN A LONGITUDINAL MAGNETIC FIELD AT A WAVELENGTH OF 3cm. D.I.Mash.
Zh. éksper. teor. Fiz., Vol. 29, No. 3(9), 390-2 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 364-6 (March, 1956).

The dependence of the angle of rotation, φ, and the loss of transmitted power upon the magnetic field intensity, H, is shown graphically for three sintered Ni-Zn ferrites of varying composition, placed in tubes of polystyrene or quartz inside circular waveguide. The dependence of φ on H for rods with diameters varying by 1 mm intervals was investigated for two of the ferrites, and graphs of the results for each are given . The normal dependence is obtained for the relatively thin ferrite rods of 3 to 8 mm in diameter (waveguide diameter, 21.8 mm). The ferrite rods of larger diameter, in which waves of higher modes are excited, show an anomalous dependence, a fact which should be taken into account when using ferrite rods.
J.J.Phipps

MOLECULAR AND ATOMIC STRUCTURE 539.1

THEORY OF SOLID STATE 539.11

539.11 : 548.7

7562. QUANTUM THEORY OF COHESIVE PROPERTIES OF SOLIDS. P.-O.Löwdin.
Advances in Phys., Vol.5, 1-171 (Jan., 1956).

An extensive review covering the following topics : calculation of electronic energy levels; symmetry functions and orthonormalization methods, including discussion of projection operators, Schmidt's method, Wannier functions; crystal symmetry and the Bloch condition (plane waves, free and nearly free electrons, expansion in atomic orbitals, orthogonalized plane waves, cellular method, augmented plane waves); crystal energy in the LCAO method, including discussion of the density and inverse overlap matrices; techniques for evaluating energy integrals; cohesive properties of ionic crystals and metals; exact solution of many-electron Schrödinger equation; valence bond method; correlation effects, including discussion of the method of alternant molecular orbitals.
E.P.Wohlfarth

539.11 : 548.7

7563. THE POTENTIAL ENERGY AND THE ELASTICITY OF THE CRYSTALLINE MEDIUM. J.Laval.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2502-5 (May 23, 1956). In French.

The potential energy of a crystal cannot be reduced to a sum of bi-atomic terms. It includes at least three atom terms which are not negligible. Nevertheless the forces of attraction between two atoms remain equal and opposite. And the laws of elasticity obtained by only taking account of the bi-atomic potential energies remain valid.
W.Bardsley

539.11 : 535.343

7564. ON THE THEORY OF TEMPERATURE SHIFT OF THE ABSORPTION CURVE IN NON-POLAR CRYSTALS. E.Antončík.
Czech. J. Phys., Vol. 5, No. 4, 449-62 (Dec., 1955).

On the assumption that valence or conduction electrons move in a periodic potential field produced by ions oscillating around their equilibrium positions an expression is derived for the dependence of the temperature shift of the absorption curve for non-polar substances of diamond structure or with a ZnS type of crystal lattice. By a method analogous to the procedure in investigating the temperature dependence of the intensity of Laue–Bragg maxima for the diffraction of X-rays it is shown that for lower temperatures this dependence is at first quadratic, later linear and at high temperatures an exponential function of the temperature. It is proved that in contrast to previous theories the qualitative character of this dependence is in agreement with experience. It is shown that for diamond, silicon and germanium the numerical values are also of the same order as the measured values.
A.

539.11

7565. A CONTRIBUTION TO THE THEORY OF THE RESONANCE TRANSFER OF EXCITATION ENERGY IN SOLIDS. M.Trlifaj.
Czech. J. Phys., Vol. 5, No. 4, 463-79 (Dec., 1955). In Russian.

A theory of the resonance transfer of excitation energy in solids is elaborated whereby the interaction of the sensitizer and activator with the atoms of the crystal lattice is taken explicitly into consideration. It is assumed that both the atom of the sensitizer and the atom of the activator interact only with a finite number of neighbouring atoms of the lattice so that one can speak of "quasimolecules" of the sensitizer and activator in a crystal. It is further assumed that the interaction of these "quasimolecules" with the rest of the crystal can be expressed by means of configuration forces (so-called external adiabaticity). The wave functions of the quasimolecules are determined by means of an adiabatic approximation and the probability per second of the resonance transfer of the excitation energy is determined by means of methods known from quantum mechanics. It is proved that under the given conditions this probability depends exponentially on the temperature and the mutual position of the emission band of the sensitizer and the absorption band of the activator which is in qualitative agreement with experiments on sensitized luminiscence. The results obtained are then used to elaborate a diffusion theory of excitons in crystals of alkali halides. The coefficient of diffusion of the excitons is calculated in dependence on the temperature and on Stokes' displacement of the emission band of an exciton. The mechanism of the external photo-effect in discoloured alkali halide crystals induced by excitons was proved theoretically.
A.

539.11 : 538.113

7566. A NOTE ON MOMENTUM CORRELATION AND DIAMAGNETISM. S.Nakajima.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 441-6 (June, 1956).

Quantum statistical mechanics is applied to derive the expression for the current response of electrons in metals, caused by an electromagnetic disturbance. The expression is closely connected with the space-time correlation of electronic momenta. Examples are given to show that diamagnetism is essentially determined by spatial correlation.
A.

539.11

7567. ON THE INTERACTION OF THE STATES OF TWO ZONES IN THE SINGLE-ELECTRON SCHEME. Yu.M.Seidov and V.S.Galishev.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 695-700 (1956). In Russian.

A contribution to the theory of electron energy levels in

netals. The results of N.N.Bogolyubov have been generalized n the zone (single-electron) approximation for the case when excited states are present. Conclusions concerning the combination of the states of two zones can be made directly on the basis of the expression for the energy spectrum thus obtained. A.

539.11 : 548.7

7568. INVESTIGATIONS IN THE THEORY OF THE ENERGY LEVELS OF ELECTRONS IN IDEAL AND PERTURBED CRYSTAL LATTICES. F.Engelmann.
Z. Phys., Vol. 145, No. 4, 430-50 (1956). In German.

Gives a solution of the eigenvalue problem for a three-dimensional crystal for which V(r) = constant when $r < b$, V(r) = 0 when $r > b$, where $b \ll a$, the lattice constant. The theory is applied to a single imperfection in a perfect crystal, and the dependence of the energy of the impurity levels is discussed qualitatively in its dependence on the strength of the perturbation. E.P.Wohlfarth

539.11 : 539.211 : 539.53

THE RELATIONSHIP BETWEEN THE CHEMICAL AND MECHANICAL STABILITIES OF VERY HARD BODIES. See Abstr. 6985

MOLECULES 539.13

539.13

7569. KINETIC ENERGY OF RELATIVE MOTION. J.O.Hirschfelder and J.S.Dahler.
J. chem. Phys., Vol. 24, No. 6, 1258 (June, 1956).

"Skewed" coordinates used by Eyring, Polanyi and Wigner to consider the relative motions of three hydrogen atoms are generalized to a system of N particles. G.Allen

539.13 : 535.37

INTERMOLECULAR TRANSFER OF ENERGY IN THE PHENOMENON OF SENSITIZED LUMINESCENCE OF ORGANIC SYSTEMS. See Abstr. 6533

539.13 : 536.23

THERMAL CONDUCTIVITY AND FORCE BETWEEN LIKE MOLECULES. See Abstr. 6556

539.13

7570. FINE STRUCTURE OF J = 1 ← 0 TRANSITION DUE TO INTERNAL ROTATION IN METHYL ALCOHOL. T.Nishikawa.
J. Phys. Soc. Japan, Vol. 11, No. 7, 781-6 (July, 1956).

The fine structure of J = 1 ← 0 lines in various isotopic species of methyl alcohol has been explained by a combination method of Itoh's theory for a rigid asymmetric hindered rotor and Kivelson's theory for a nonrigid symmetric hindered rotor. All lines have been fitted within errors of 2 Mc/s by this method. From the analysis the height of potential barrier to internal rotation for CH_3OD has been determined to be $371 \pm 5\ cm^{-1}$. The molecular structure of methyl alcohol has also been calculated and discussed. A.

539.132

7571. EVALUATION OF AUXILIARY FUNCTIONS IN MOLECULAR THEORY. T.C.Chen.
J. chem. Phys., Vol. 24, No. 6, 1268-9 (June, 1956).

The computation of auxiliary functions for two-centre integrals involves the evaluation of

$$Bn(x) = \int_{-1}^{+1} t^n e^{-xt}\,.\,dt = x^{-n-1}[e^x Cn(-x) - e^{-x} Cn(x)].$$

Corbato (Abstr. 3876/1956) has discussed the evaluation using a development in spherical Bessel functions. An alternative method is suggested in which Cn(x) is written as a truncated exponential function. This is valid for both integral and non-integral values of n. G.Allen

539.132

7572. THE INFLUENCE OF THE HOMOPOLAR PART OF THE BINDING ON THE STRUCTURE OF INORGANIC SALTS. II. SEMICONDUCTING AND ALLOYED PHASES. H.Krebs.
Acta cryst., Vol. 9, Pt 2, 95-108 (Feb., 1956). In German.

For Pt I see Zeitschrift für anorganische Chemie, Vol. 278, 82 (1955). An attempt has been made to characterize more exactly the homopolar component of the binding in inorganic compounds and to relate it to their structural, electric and magnetic properties. PbS (NaCl structure) is characterized by resonance binding of electrons in the p state from both the sulphur and lead atoms; the resonance reduces the width of the forbidden zone for electrons. Arsenic, antimony and bismuth are isoelectronic with PbS and therefore crystallize in a salt-like structure and are metals. Similarly, resonance binding occurs in black phosphorus and in hexagonal selenium and tellurium, and accounts for the fact that they are semiconductors. In the Zintl phases with the CsCl structure (e.g. MgTl) the Tl^{2-} ions form a NaCl-like structure with resonance chains in the [100] directions. In the fluoride structure the metal in the Ca sites is characterized by a d^3s-hybrid (e.g. CaF_2, CeO_2), or by a directionally degenerate sp^3-hybrid (Na_2O, Cu_2S, Be_2S, and Mg_2Si). Binding in the Zintl phases of the Li_3N- and Na_3As-types is also discussed. The properties of abrasive materials such as TiC, TiN etc., which have the NaCl structure, are associated with resonance binding between electrons in the p state in the non-metal and the d state in the metal atom. In layer lattices of the GdI_2-type valence electrons occur in the non-metallic component in the p state. They take part in binding not only to the metal atoms but also to the other neighbouring non-metallic atoms. A.

539.132

7573. DETERMINATION OF THE STRUCTURE OF METALLIC CHLORATES BY INFRARED ABSORPTION SPECTROGRAPHY. C.Rocchiccioli.
C.R.Acad. Sci. (Paris), Vol. 242, No. 25, 2922-4 (June 18, 1956). In French.

The identification of 6 vibration frequencies for 15 chlorates suggests that the chlorate ion is an unsymmetrical pyramid. Force constants are calculated. G.F.Lothian

539.132

7574. PARAMAGNETIC RESONANCE IN DILUTE IRON GROUP FLUORIDES. II. WAVE FUNCTIONS OF THE MAGNETIC ELECTRONS. M.Tinkham.
Proc. Roy. Soc. A, Vol. 236, No. 1207, 549-63 (1956).

The data on the g, A and D tensors and on the fluorine hyperfine structure coupling tensors for paramagnetic ions in a ZnF_2 lattice are interpreted in terms of 3d orbitals augmented by attached fluorine wave-functions of appropriate symmetry. It is suggested that fluorine 3s and 3p functions are required, in addition to the 2s and 2p functions usually assumed, to give quantitative agreement between the fluorine h.f.s. coupling and the spin-orbit coupling reduction effects. The presence of n = 3 functions also renders the dependences on internuclear distance more easily understood. Charge transfer by π- and σ-bonding seems to be of the same order, but the s-electron contact interaction of the σ-bonding electrons gives the dominant h.f.s. interaction. Particularly complete analyses are possible for Mn^{2+} and Fe^{2+}. In these cases, it is estimated that the magnetic electrons have a probability of about 6% of being in fluorine n = 2 orbitals, about the same of being in fluorine n = 3 orbitals, roughly 25% of being in the overlap region, leaving only about $(60 \pm 10)\%$ probability of being on the central ion. The charge transfer in the case of Co^{2+} is believed to be less, and perhaps more typical of the situation when the ions are in their own lattices, with proper lattice parameter. The

absence of resolved fluorine h.f.s. with Cr^{3+} is consistent with the absence of $d\gamma$ electrons in the $3d^3$ configuration in an octahedral environment. A.

539.132

7575. He–He REPULSIVE POTENTIAL. I. M.Sakamoto and E.Ishiguro.
Progr. theor. Phys., Vol. 15, No. 1, 37-49 (Jan., 1956).

The repulsive potential between two normal He atoms has been calculated theoretically. In order to include the effect of deformation of the atomic orbitals, a wave-function similar to those used by Inui (1938) and Nordsieck (1940), in their calculations of the H_2 molecule, is composed, from which the repulsive potential is obtained. The result is $V(R) = 4.08755 \times 10^2 e^{-4.46893R}$ eV ($0.53 A < R < 1.06 A$). Comparison with potential curves obtained by various theories and by experiment is made. Discussions and illustrations concerning the nature of AO's here obtained are given. A.

539.132 : 533.15

HIGHER APPROXIMATIONS TO DIFFUSION COEFFICIENTS AND DETERMINATION OF FORCE CONSTANTS.
See Abstr. 6422

539.132

7576. ROTATIONAL ISOMERISM IN 1, 2-DIBROMO-2, 2-DIFLUORETHANE. R.E.Kagarise.
J. chem. Phys., Vol. 24, No. 6, 1264-5 (June, 1956).

An attempt is made to correlate the Raman spectrum of liquid, and the infrared spectra of liquid and solid $CH_2Br–CF_2Br$ with the presence of the trans- and gauche- isomeric species, respectively. Results are not conclusive.

G.I.W.Llewelyn

539.132 : 535.343

7577. MICROWAVE SPECTRA, DIPOLE MOMENT AND BARRIER TO INTERNAL ROTATION OF CH_3NO_2 AND CD_3NO_2. E.Tannenbaum, R.J.Myers and W.D.Gwinn.
J. chem. Phys., Vol. 25, No. 1, 42-7 (July, 1956).

The J = 1 to J = 2 and J = 2 to J = 3 transitions for CH_3NO_2 and CD_3NO_2 have been assigned for several internal rotational states. The best values of the rotational constants B and C were found to be 10 542.7 and 5876.7 Mc/s for CH_3NO_2 and 8697.1 and 5254.3 Mc/s for CD_3NO_2. The rotational constant for the NO_2 group about the symmetry axis is 13 277.5 Mc/s. These constants are determined assuming no inertial defect, slightly different values are calculated if other assumptions are made. Some of the assigned lines are a very sensitive function of the low barrier to internal rotation. The barrier term V_6 was determined to be 6.03 ± 0.03 calories/mole for CH_3NO_2 and 5.19 ± 0.03 calories/mole for CD_3NO_2. The term V_{12} is less than 0.05 calorie/mole. The dipole moment of CH_3NO_2 is 3.46 ± 0.02 Debye units. A.

539.132 : 535.343

7578. SOME VIBRATION-ROTATION BANDS OF DIAZOMETHANE. W.H.Fletcher and T.P.Garrett.
J. chem. Phys., Vol. 25, No. 1, 50-5 (July, 1956).

Three parallel fundamentals and one perpendicular overtone have been resolved with a grating spectrometer and the results analysed. The ground state rotational constants are $B'' = 0.371$ cm^{-1} and $A'' - B'' = 8.64$ cm^{-1}, and the band origins are $\tilde{\nu}_2 = 2102.2$, $\tilde{\nu}_3 = 1414.4$, $\tilde{\nu}_4 = 852.3$ and $\tilde{\nu}_3 + \nu_6 = 4579.3$ cm^{-1}. The two skeletal bending bands have been observed with CsBr and KBr prisms and interpreted in terms of strong Coriolis coupling. The fundamental frequencies are approximately 408 and 422 cm^{-1}. A.

539.132

7579. ELECTRONIC AND VIBRATIONAL STATES OF ANTHRACENE. J.W.Sidman.
J. chem. Phys., Vol. 25, No. 1, 115-21 (July, 1956).

The polarized absorption and fluorescence spectra of anthracene have been measured in dilute solid solution in single crystals of naphthalene and phenanthrene at 20°K. The lowest singlet–singlet transition is proven to be polarized along the short molecular axis, and hence $^1B_{2u} - {}^1A_g(^1L_a - {}^1A)$, in agreement with theoretical predictions. Vibrational frequencies are compared in the ground state and in the first excited state. The polarization of the fluorescence of anthracene in phenanthrene has also been studied as a function of temperature. The fluorescence is partially polarized at 300°K, but is depolarized at 20°K. A.

539.132

7580. ELECTRONIC AND VIBRATIONAL STATES OF TETRACENE (NAPHTHACENE). J.W.Sidman.
J. chem. Phys., Vol. 25, No. 1, 122-4 (July, 1956).

The absorption and fluorescence spectra of tetracene have been studied in substitutional solid solutions in naphthalene and in anthracene at 20°K. In agreement with theoretical predictions, the lowest excited singlet state at 20 246 cm^{-1} is $^1B_{2u}$, ^1L_a, since the transition with the ground state is polarized along the short molecular axis. Vibrational frequencies of tetracene are compared in ground and excited electronic states, and are compared with the vibrations of anthracene and naphthalene. A.

539.132

7581. NORMAL COORDINATE TREATMENT OF THE OUT-OF-PLANE VIBRATIONS OF ETHYLENE-TYPE MOLECULES. J.M.Dowling.
J. chem. Phys., Vol. 25, No. 2, 284-7 (Aug., 1956).

The s vectors for torsional and out-of-plane bending modes of vibration for ethylene-type molecules are given. Then F and G matrix elements are given for all ethylene-type molecules with the exception of C_2XYZW isomers. Finally, numerical calculations are carried out for C_2H_4, asymmetric $C_2H_2F_2$, asymmetric $C_2H_2Br_2$, the cis- and trans-isomers of $C_2H_2Cl_2$ and all of their deuterated analogues. The 57 out-of-plane fundamentals were calculated for the above 19 molecules. Of these 57 fundamentals 50 have been reported in the literature and are reproduced with an average deviation of 2.2 K or to 0.362% error. A.

539.132 : 541.57

7582. BOND MOMENTS AND MOLECULAR STRUCTURE. D.F.Hornig and D.C.McKean.
J. phys. Chem., Vol. 59, No. 11, 1133-40 (Nov., 1955).

Discusses the question of what information concerning molecular structure can be or has been obtained from the intensities of infrared vibration bands. The first part summarizes the assumptions involved and information required in relating the intensity of a fundamental vibration band to bond parameters μ and $\partial\mu/\partial r$. The need for accurate knowledge of the potential function is stressed In the second part the available data on μ and $\partial\mu/\partial r$ are surveyed with a view to examining (a) their self-consistency and (b) the question as to whether "infrared" and "static" bond moments can be regarded as equal. It is seen that the only self-consistency lies in the order of magnitude of the values found. From the results from molecules containing CN groups it appears that infrared and static bond moments are not the same quantity. In the third part the possible influence of unshared pairs of electrons on bending vibration intensities is considered for the specific cases of NH_3 and HCN. It is shown that rehybridization or reorientation of these electrons may largely determine the bond moments found in these molecules. It is also suggested that the high CH moments found in C_2H_4 and C_2H_2 are due to movements of charge in the double or triple carbon–carbon bonds. Some general conclusions are summarized. A.

539.132

7583. ENERGY LEVELS AND THERMODYNAMIC FUNCTIONS FOR MOLECULES WITH INTERNAL ROTATION. IV. EXTENDED TABLES FOR MOLECULES WITH SMALL MOMENTS OF INERTIA. J.C.M.Li and K.S.Pitzer.

. phys. Chem., Vol. 60, No. 4, 466-74 (April, 1956).

For Pt III see Abstr. 1901 (1950). Additional theoretical evelopments have made it possible to present general tables or the thermodynamic properties of a restricted rotator which re applicable to molecules with very small moments of inrtia. Additional eigenvalues for the Mathieu equation were btained for these calculations. These eigenvalues will be of se also in the interpretation of spectral data for restricted otators. A.

539.132 : 538.567.3 : 538.561 : 621.375.9 : 621.373

THEORY OF THE MOLECULAR GENERATOR AND THE MOLECULAR POWER AMPLIFIER. See Abstr. 6803

539.132

7584. ENERGY INTEGRALS FOR 3d ELECTRONS IN BODY-CENTRED IRON. M.Suffczyński.
Acta phys. Polon., Vol. 14, No. 6, 493-5 (1955).

Analytical expressions for the wavefunctions were found by a procedure similar to Löwdin's (Abstr. 4296/1953) fitting self-consistent calculations by previous authors. The energy integrals were calculated with the same approximations as used by Fletcher (Abstr. 3759/1952). Results (in eV): for nearest neighbours, $(dd\sigma)_1 = -0.69876$; $(dd\pi)_1 = 0.4287$; $(dd\delta)_1 = -0711$; for next nearest neighbours, $(dd\sigma)_3 = -0.3222$; $(dd\pi)_3 = 0.1593$; $(dd\delta)_3 = -0.02206$. These values appear too great and this is due to the atomic field having been calculated without exchange. L.Pincherle

539.132

7585. PLASMA OSCILLATION OF π ELECTRONS IN CAROTENOIDS. G.Araki.
J. chem. Phys., Vol. 24, No. 6, 1269-70 (June, 1956).

The convergence limit of the wavelength of absorption maxima of carotenoids reached with increase of molecular length corresponds to the frequency of the plasma oscillation of π electrons contained in the conjugated chain.

G.I.W.Llewelyn

539.132

7586. ELECTRONIC STATES OF MOLECULES. I. ELECTRONIC STRUCTURE OF BH. R.C.Sahni.
J. chem. Phys., Vol. 25, No. 2, 332-6 (Aug., 1956).

The calculation of the wave-function of the ground state ($1\,^1\Sigma^+$) of the BH molecule, by the self-consistent field (SCF) molecular orbital (MO) method, is reported together with its ionization potentials, dipole moment, total energy and the binding energy. For these calculations, the interactions of all the electrons have been included explicitly and all integrals have been computed exactly at the internuclear equilibrium distance, 1.2325 A, of BH. The electron distribution analysis is carried out to get intimate insight into the distribution of charges around and between the nuclei and to determine the bonding and antibonding nature of MO's. This analysis supports the previous results of the SCF MO treatment of CO, where the most easily ionized electrons are in an MO which has a large gross atomic population and the most bonding power resides in the lowest energy outer-shell MO. The comparison of the results of the present calculation with those of the previous calculations shows that the SCF MO treatment gives more accurate values of wave-function and energy levels for a polar molecule than those for a homopolar molecule. A.

539.132

7587. APPROXIMATE MOLECULAR ORBITALS. V. THE $1s\sigma$ AND $2p\pi$ STATES OF HeH^{2+}. B.L.Moiseiwitsch and A.L.Stewart.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 480-8 (June, 1956).

For Pt IV see Abstr. 6060/1956 . Approximate wave functions for the $1s\sigma$ and $2p\pi$ states of the HeH^{2+} molecular ion are obtained by the variational method. The values of the electronic total energies, potential energies, dipole moments and quadrupole moments computed using the approximate wave functions are compared with the exact values of these quantities. A.

539.132 : 535.343

7588. ON THE λ 1600-1350 ABSORPTION SYSTEM OF NITROGEN DIOXIDE AND ITS ELECTRONIC STRUCTURE. K.Mori.
Sci. of Light (Tokyo), Vol. 4, No. 2, 130-47 (Nov., 1955).

Photographs of the absorption bands of NO_2 in the region of λ 1600-1350 have been taken under the medium dispersion (about 2A/mm). The Lymann continuum was employed as the light source for the background. Two separate electronic systems appear to be involved in this region. The relatively long v_1' and v_2' progressions indicate that both the bond length and the apex angle of the molecule change considerably in the transition to the excited electronic state. The complexity of the structure of the bands also suggests that the molecule in its upper state becomes more asymmetrical. From the vibrational analysis it is concluded that the λ 1600-1350 system corresponds to the transition from the double bond orbitals to the antibonding orbital containing the odd electron. A.

539.132 : 535.343

FINE STRUCTURE ANALYSIS AND MUTUAL PERTURBATION OF THE δ AND β BANDS OF THE NO MOLECULE. See Abstr. 6526

539.132 : 539.133

7589. NUCLEAR MAGNETIC RESONANCE. STRUCTURE OF THE AMINO GROUP. II. W.G.Moulton and R.A.Kromhout.
J. chem. Phys., Vol. 25, No. 1, 34-7 (July, 1956).

For Pt I, see Abstr. 9804 (1955). The nuclear magnetic resonance spectra of powder samples of hydroxylamine hydrochloride and oxamide have been obtained. N—H bond distances were calculated to be 1.036 ± 0.025 A in formamide, and 1.039 ± 0.013 A in oxamide, assuming a 120^0 bond angle and a planar structure in each case. An attempt is made to correlate the N—H bond lengths with the hydrogen bond length by a modification of Lippincott's theory of the linear O....O hydrogen bond. The rigid lattice second moment of cyanamide was also measured. The result is not consistent with the assumption of an ammonia-like N—H bond structure, but requires a larger H—H separation. A.

539.132

7590. SOME BROMINE, IODINE, AND INDIUM NUCLEAR QUADRUPOLE INTERACTION FREQUENCIES. G.W.Ludwig.
J. chem. Phys., Vol. 25, No. 1, 159-71 (July, 1956).

Quadrupole interaction frequencies due to Br^{79} and I^{127} are reported in a number of crystalline solids. Br^{79} interaction frequencies in bromobenzene derivatives and I^{127} frequencies in iodobenzene derivatives are correlated with Hammett's σ. The splitting between interaction frequencies found in s-tribromophenol and related di- and tri-bromobenzene derivatives is explained tentatively on the basis of hindered rotation. Coupling constants and asymmetry parameters for I^{127} in iodobenzene derivatives are reported and discussed in terms of the single bond, double bond, and ionic character of the carbon-iodine bond. Owing to the large asymmetry ($\sim 45\%$) of the I^{127} quadrupole coupling in HIO_3, the $|\Delta m| = 2$ transition could be observed as well as the two $|\Delta m| = 1$ transitions. Eight interactions frequencies were found in InI_3, two of which (at 26.93 Mc/s and 36.33 Mc/s) are attributed to $(\pm 7/2 \leftrightarrow \pm 7/2)$ transitions of In^{115}. From these two frequencies a coupling constant and asymmetry parameter of 219.8 ± 0.3 Mc/s and $32.0 \pm 4.0\%$, respectively, are evaluated for In^{115} in this compound. A.

539.132

7591. NUCLEAR MAGNETIC INTERACTIONS IN THE HF MOLECULE. I.Solomon and N.Bloembergen.
J. chem. Phys., Vol. 25, No. 2, 261-6 (Aug., 1956).

Magnetic relaxation times of hydrogen and fluorine in anhydrous hydrofluoric acid cannot be accounted for on the as-

sumption of a pure dipole-dipole interaction between the hydrogen and the fluorine nuclei in the same molecule. However, the introduction, in the Hamiltonian, of a scalar term AI.S resulting from the indirect electron-coupled interaction between the two nuclei removes all the discrepancies between the calculated and observed decay times. Although the splitting due to this scalar term is smeared out by the rapid chemical exchange of the protons with the traces of water present in the acid, the nuclear Overhauser effect provides the extra parameter required to separate the dipole-dipole interaction from the scalar interaction and to calculate separately the scalar splitting and the exchange rate of the protons. The value obtained for the splitting is $A/h = 615$ c/s. The same method has been applied to investigate the structure of the HF molecule in solutions. The experimental results can be explained qualitatively by the following picture: (a) The fluorine nuclei form long chains that move more slowly than the Larmor frequency of fluorine. (b) The chemical exchange with the relatively large quantity of water present makes the motion of the hydrogen nuclei fast with respect to the hydrogen Larmor frequency. The results are: Long relaxation times for hydrogen with T_1 and T_2 equal, relatively short relaxation times for fluorine resonance, with T_2 shorter than T_1. Solutions of salts of hydrofluoric acid (KF) show the same character as solutions of the acid. A.

539.132

7592. PROTON MAGNETIC RESONANCE ABSORPTION SPECTRA OF LONG CHAIN NORMAL PRIMARY ALCOHOL OF PROBABLE CARBON NUMBER 32. H.Komatsu.
J. Phys. Soc. Japan, Vol. 11, No. 7, 755-9 (July, 1956).

Proton magnetic resonance absorption from long-chain normal primary alcohol of probable carbon number 32 was observed between 120°K and its melting point 355°K. Its absorption line width and second moment were constant below 260°K, being 15.5 gauss and 26.5 gauss^2, respectively. From 260°K to the transition point, the line width decreases gradually with increasing temperature and, at the transition point, abruptly decreases to 4.6 gauss. The narrowing of the absorption line below the transition point is considered to be due to the torsional vibration of the molecules around the carbon chain axis. The relation between the dielectric anomaly below the transition point observed by Takamatsu and the molecular motion revealed from nuclear resonance studies is discussed. A.

539.132

7593. THE PROTON MAGNETIC RESONANCE SPECTRA OF CONJUGATED AROMATIC HYDROCARBONS.
H.J.Bernstein, W.G.Schneider and J.A.Pople.
Proc. Roy. Soc. A, Vol. 236, No. 1207, 515-28 (1956).

The proton resonance spectra of a number of alternant aromatic hydrocarbons are reported. With the exception of benzene and pyrene, two or more signals were obtained for each hydrocarbon. A probable assignment of the spectrum for each compound is given, and this was confirmed for anthracene and phenanthrene by deuteration. The spectrum of the non-alternant hydrocarbon azulene is also presented. The observed nuclear magnetic resonance spectra of the aromatic hydrocarbons cannot be interpreted on the basis of symmetry considerations or π-electron density, but are readily explained in terms of a simple model based on induced diamagnetic currents in the conjugated aromatic rings. The spectra calculated for each hydrocarbon on the basis of this model satisfactorily reproduce the main features of the observed spectra. A.

539.132

7594. THE LOCALIZED MOLECULAR ORBITALS AND THE STRUCTURE OF SOME XH_3 MOLECULES. W.Kolos.
Acta phys. Polon., Vol. 14, No. 6, 471-82 (1955).

The method of equivalent orbitals in the two-centres approximation for bond orbitals is used to calculate the variation with bond angle of the total energy of the NH_3 and PH_3 molecules. A modification of the orthogonality conditions for the orbitals enables to calculate the bond angles of the equilibrium configuration in a qualitative agreement with experiment. It is shown that the theory in this approximation over-emphasizes the hybridization of the lone pair orbital as compared to that of the bond orbitals, and over-emphasizes the part played by the lone pair electrons in determining the molecular structure. A.

539.132

7595. INVESTIGATION OF THE TWO-DIMENSIONAL HOMOLOGOUS SERIES OF AROMATIC COMPOUNDS.
R.Pauncz.
Acta phys. Hungar., Vol. 6, No. 1, 15-31 (1956).

On analysing Heilbronner's method for the study of the two-dimensional homologous series of aromatic compounds it would appear that whilst it renders correct results for the polyacene series as well as the square lattice, for the two-dimensional homologous series it does not yield the eigenvalue of the elements of a true two-dimensional homologous series but those of such variants, in which the integral of the Coulomb interaction of the atoms in the uppermost and lowest rows differ by $\pm\beta$ from the integral of the Coulomb interaction of all the other atoms in the molecule. With this fact in mind, and the perturbation theory involved, it is possible to obtain approximate values for the energy values of the elements of the two-dimensional homologous series. The values thus obtained are in good agreement with the eigenvalues calculated by the exact method. A.

539.132

7596. ELECTRONIC INTERACTION IN THE FREE-ELECTRON NETWORK MODEL FOR CONJUGATED SYSTEMS. I. THEORY. N.S.Ham and K.Ruedenberg.
J. chem. Phys., Vol. 25, No. 1, 1-13 (July, 1956).

The free-electron network model for conjugated systems is extended to include electronic interaction. The free-electron wave functions are considered as molecular orbitals arising from an average one-electron potential, and a configuration interaction treatment with these MO's is developed. The integrals occurring in this procedure, in particular the electron interaction integrals, are analysed and a convenient method for their computation in the FE model is suggested. The integral evaluation requires certain semiempirical parameters which are determined from the benzene spectrum. A.

539.132

7597. ELECTRONIC INTERACTION IN THE FREE-ELECTRON NETWORK MODEL FOR CONJUGATED SYSTEMS. II. SPECTRA OF AROMATIC HYDROCARBONS. N.S.Ham and K.Ruedenberg.
J. chem. Phys., Vol. 25, No. 1, 13-26 (July, 1956).

A theoretical calculation is presented for the main u.v. transitions of the polyacenes, azulene, phenanthrene, the isomers of naphthacene and the peri-condensed systems pyrene and coronene. A configuration interaction treatment, based on antisymmetrized products of free-electron molecular orbitals, is carried out, using the methods developed for this purpose in the previous paper. Transition energies, intensities and polarizations compare well with experiment. Particular emphasis is placed upon illuminating the various factors influencing the spectra in the series of molecules considered. A.

539.132

7598. CHARGE DISTRIBUTION IN THE PENTABORANES.
W.N.Lipscomb.
J. chem. Phys., Vol. 25, No. 1, 38-41 (July, 1956).

A study of free electron distributions in a hemispherical box and a hemispherical shell, and a study of simplified LCAO models for B_5H_9 and B_5H_{11}, indicates the general nature of the charge distribution in these highly unsymmetrical molecules. A.

539.132

7599. PHYSICAL BASIS OF THE FREE-ELECTRON GAS MODEL OF BRANCHED MOLECULES. H.Kuhn.
J. chem. Phys., Vol. 25, No. 2, 293-6 (Aug., 1956).

The postulatory nature of the electron gas model is discussed. It is pointed out that the one-dimensional waves introduced in the model are not wave-functions in the strict quantum-mechanical sense, since they are not solutions of a clear-cut quantum-mechanical problem. Rather, the free electron model is to be viewed as a device which, similar to the vector model of atomic spectra terms, predicts on the basis of simple calculations the result of rigorous quantum-mechanical treatments. The value of the postulates of the free-electron model is indicated by how well the one-dimensional waves imitate the results of the strict treatment. It is shown that a recently given alternate postulate regarding the treatment of branch points leads, in this respect, to an improvement of the model. A.

539.132

7600. USE OF F-ORBITALS IN COVALENT BONDING. J.C.Eisenstein.
J. chem. Phys., Vol. 25, No. 1, 142-5 (July, 1956).

The hybridization of atomic orbitals is considered from a group theoretical point of view. The earlier work of Kimball is extended to include atomic f-orbitals in the hybrids. By use of the tables presented it is possible to tell at a glance what atomic orbitals can be combined to form bonding orbitals for a number of different spatial arrangements of the bonds. The strength of the hybrids is calculated for a few particularly symmetrical arrangements. Finally, the complexes $(UO_2)^{++}$, UCl_6 and UCl_4 are discussed and it is argued that f-orbitals on the uranium atoms are used for covalent bonding. A.

539.132

7601. BINDING IN SOME DIATOMIC MOLECULES. J.W.Linnett.
J. Chem. Soc., 1956, 275-87 (Feb).

The electronic configurations of a number of states of C_2, N_2, N_2^+, O_2, and O_2^+ have been considered and it has been shown that it is possible, and in some ways convenient, to describe them in terms of a combination of atomic and molecular orbitals. On this basis the number of electrons having a high probability of being between the two nuclei has been assessed for the various states and it has been shown that, to a good approximation, the bond lengths, relative to the Pauling single-bond lengths, are dependent (a) on the number of bond electrons, and (b) on the way in which these are distributed between σ and π orbitals. A similar behaviour is found for the force constants. The molecules CN, CO, CO^+, and NO have been examined with analogous results. The electronic configurations of maximum probability have been derived, and those of O_2 and other molecules considered. The stability of NO and other odd-electron molecules is discussed. A.

539.132

7602. COULOMB REPULSION INTEGRALS (pp|pp) AND BONDING POWER OF AN ATOM IN A GIVEN VALENCE STATE. L.Paoloni.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 410-17 (Aug., 1956).

The semiempirical method, previously used by Pariser and Parr (Abstr. 5636/1953), for evaluating (pp|pp) repulsion integrals has been generalized and extended to the whole set of the first and second row atoms, in their valence states purely p and hybridized sp. This generalization allows an energy measure to be obtained of the bonding power of an atom in a given valence state, which appears adequate to solve some difficulties, pointed by by Pritchard and Skinner and originated from the comparison of the promotion energies with the behaviour of the O, N, S and P atoms in their isovalent hybrid states. A.

539.132

7603. ON THE MOLECULAR COMPLEX NO_4. I.C.Hisatsume and B.Crawford, Jr.
J. chem. Phys., Vol. 24, No. 6, 1257 (June, 1956).

An unsuccessful attempt to detect infrared absorption bands due to NO_4, in a mixture of NO_2 and O_2 at pressures up to 500 lb/in^2. It is concluded that

$$K[(NO_4)/(NO_2)(O_2)] \leq 2.9 \times 10^{-7}\ mm^{-1} \text{ at } 23^\circ C.$$

G.Allen

539.132

7604. FIRST-ORDER DECOMPOSITION OF EXCITED ANILINE MOLECULES IN THE VAPOR PHASE. B.Stevens.
J. chem. Phys., Vol. 24, No. 6, 1272-3 (June, 1956).

The variation of the emission life-time with exciting wavelength over the range 2878-2529 A gives a means of determining the variation of the dissociation probability for aniline vapour at 1.6 mm Hg pressure and 70°C. A vibrational temperature is also assigned to the molecule of aniline and the relation of this to the dissociation constant determined. G.F.J.Garlick

539.132

7605. THE DISSOCIATION ENERGY OF THE NITROGEN MOLECULE. D.C.Frost and C.A.McDowell.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 278-84 (Aug. 2, 1956).

The electron-induced dissociation of nitrogen by essentially monoenergetic electrons has been studied in a mass spectrometer. It has been found that there are three ways by which the atomic nitrogen ions are produced, namely, those in which the accompanying nitrogen atom is produced in its three states, $^4S^0$, $^2D^0$, and $^2P^0$; the atomic nitrogen ion being always formed in its ground (^3P) state. The appearance potentials at which these three processes occur lead unequivocally to the conclusion that the dissociation energy of the nitrogen molecule is 9.756 eV. A.

539.133 : 535.343

7606. MILLIMETER WAVE SPECTRUM, MOLECULAR STRUCTURE, AND DIPOLE MOMENT OF HYDROGEN SELENIDE. A.W.Jache, P.W.Moser and W.Gordy.
J. chem. Phys., Vol. 25, No. 2, 209-10 (Aug., 1956).

Several rotational transitions of various Se isotopic species of H_2Se and D_2Se have been measured in the shorter millimetre wave region. These yield the value of 1.460 ± 0.013 A for the bond length and $91.0^\circ \pm 0.6^\circ$ for the bond angle. From Stark effect measurements on two of the transitions the value 0.24 ± 0.02 Debye is obtained for the molecular dipole moment. A.

539.133

7607. DIPOLE MOMENT OF THE HCN MOLECULE. K.Iguchi.
J. chem. Phys., Vol. 25, No. 2, 217-19 (Aug., 1956).

π-electronic and σ-electronic energy levels of the HCN molecule are calculated by the LCAO method with full inclusion of configuration interaction. Slater atomic orbitals with effective charge Z=3.180 for the carbon atom and 3.850 for the nitrogen atom are employed. The C—H distance is assumed to be 1.09 A and the C—N distance 1.15 A. The value 2.664 Debye units is obtained for the dipole moment of the molecule in the ground state, while the experimental value is 2.766 Debye units. A.

539.133 : 539.27

7608. ELECTRON DIFFRACTION INVESTIGATION OF THE MOLECULAR STRUCTURE OF DICHLORODIFLUOROMETHANE. R.L.Livingston and D.H.Lyon.
J. chem. Phys., Vol. 24, No. 6, 1283-4 (June, 1956).

The results obtained from electron diffraction photographs of CCl_2F_2 are compared with those to be expected from various models and with those previously obtained by other workers. J.Thewlis

539.133

7609. WAVELENGTH FORMULAS AND CONFIGURATION INTERACTION IN BROOKER DYES AND CHAIN MOLECULES. J.R.Platt.
J. chem. Phys., Vol. 25, No. 1, 80-105 (July, 1956).

The zero-order wavelength of absorption, λ_I, of a conjugated chain of N bonds with all bonds equal is $\lambda I = N\lambda_C + \lambda_L + \lambda_R$, where λ_C is a universal constant, about 500 A per bond, and λ_L, λ_R are end-group corrections. The corresponding energy, E_I, is modified in second-order by configurational mixing of the ground state with a certain excited state, to give within experimental error the observed transition energy $E = [E_I^2 + (b_L - b_R)^2]^{1/2}$. The derivation is a simplified adaptation of the ideas of Brooker, Herzfeld and Sklar. The end-group basicities, b_L and b_R, or stabilizations of alternative resonance structures, locate the electron density maxima in the chain and determine the bond density alternations and bond length alternations that probably produce the mixing. They are additive and consistent for over 50 end groups and can be derived theoretically in many cases. Their dependence on chain length and solvent is shown. Substituent groups have two parameters, λ, b, as in aromatic ultraviolet spectra. The changes in transition band widths, vibrational structure, and intensity in changing solvents are accounted for. The strong convergence of polyene series spectra and the nonharmonic spacing of their higher states is attributed to their large b-values, about 20 kK. The corresponding mixing of states is related to the probable character of the excited state wave-functions and to the probable strong alternation of polyene bond lengths even in long chains. A.

539.133

7610. POLARIZATION OF RAMAN LINES OF IODIC ACID AND THE STRUCTURE OF THE ACID MOLECULE. J.R.Saraf.
Sci. of Light (Tokyo), Vol. 4, No. 2, 157-62 (Nov., 1955).

Gives the results of depolarization measurements of a 4.5 N and a 0.2 N iodic acid solution. The results show that all the lines are polarized, pointing to the conclusion that the iodic acid molecule has no element of symmetry and, therefore, is likely to exist mainly in the form of polymer. The structure of the HIO_3 molecule has been shown to be of the type AB_2B', i.e., a pyramid with an isosceles base. A.

539.133

7611. ATTEMPT TO INTERPRET INFRARED ABSORPTION SPECTRA OF SALTS OF THE TYPE XO_3Y, IN PARTICULAR AMIDO-SULPHONATES. T.Dupuis.
C.R. Acad. Sci. (Paris), Vol. 242, No. 25, 2924-6 (June 18, 1956). In French.

The vibrational spectra of salts of amido-sulphonic acid show that the ion $SO_3NH_2^-$ is tetrahedral, as are the ions of sulphuric, thiosulphuric and selenosulphuric acids.

G.F.Lothian

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1

7612. LOW ENERGY LEVELS IN N^{16}. R.T.Pauli.
Ark. Fys., Vol. 9, Paper 36, 571-601 (1955).

The reaction $O^{18}(d, \alpha)N^{16}$ was used for the determination of the low levels of N^{16}. The energies of the α-particles were measured with a double focusing magnetic spectrometer. Four α-groups were found with Q-values 4237 ± 9, 4121 ± 9, 3937 ± 10, 3846 ± 11 keV. The lowest of the four corresponding levels, which is 10.39 ± 0.03 MeV above the O^{16} ground state, is probably the ground state of N^{16}. L.Pincherle

539.152.1

7613. SHELL EFFECTS ON THE SPACING OF NUCLEAR LEVELS. T.D.Newton.
Canad. J. Phys., Vol. 34, No. 8, 804-29 (Aug., 1956).

Recent measurements of resonances in slow neutron total cross-sections yield good estimates of the average level spacing, D, in medium and heavy nuclei. These spacings show large variations, by factors of 10^1 to 10^5, in the region of magic numbers of nucleons. There are also variations by smaller factors between nuclei with even and odd numbers of protons or neutrons. The even–odd effect is a co-operative phenomenon; it can be approximately treated by redefining the ground state to be used for a Fermi gas model. After this correction the gas model should predict D with reasonable accuracy since it is required only to define the density of a complete set of states. The magic number variations are shown to be fitted by an improved approximation to the single-nucleon level density. This is obtained from the observed sequence of single particle spins and the assumption that the energy interval between spin subshells is constant. Fifty-two observed spacings are fitted by a two-parameter formula with an average uncertainty factor 3. Many of the larger remaining differences between observation and the predictions of the model are qualitatively explicable as expected departures from this uniform spacing hypothesis. A.

539.152.1

7614. NUMERICAL CALCULATIONS FOR THE NEUTRON–PROTON SYSTEM WITH TENSOR FORCES. M.H.Kalos, L.C.Biedenharn and J.M.Blatt.
Nuclear Physics, Vol. 1, No. 4, 233-44 (March, 1956).

Low-energy properties of the neutron–proton system are tabulated for a variety of central and tensor potentials. A.

539.152.1

7615. COLLECTIVE MOTIONS OF A SHELL STRUCTURE. J.M.Araújo.
Nuclear Physics, Vol. 1, No. 4, 259-77 (March, 1956).

Collective motions in atomic nuclei are studied using a generalized independent-particle model (time-dependent well potential). After calculating nucleon wave-functions in a time-dependent infinitely deep well, the expectation values of the energy and angular momentum are evaluated. These are shown to be formally identical with the liquid-drop quantities. By imposing on the expectation value of the energy the condition of time independence, an eigenfrequency equation is obtained. The calculated frequencies and static deformabilities show considerable fluctuations. Some experimental evidence for these fluctuations is discussed. A.

539.152.1

7616. ORBITAL MOMENTUM FORBIDDEN MAGNETIC DIPOLE TRANSITIONS IN SOME ODD PROTON NUCLEI. H.de Waard and T.R.Gerholm.
Nuclear Physics, Vol. 1, No. 4, 281-301 (March, 1956).

The half lives of the following excited nuclear states have been measured with delayed coincidence techniques:

145 keV level in Pr^{141}: $T_{1/2} = (19 \pm 2) \times 10^{-10}$ sec
163 keV level in La^{139}: $T_{1/2} = (15 \pm 1) \times 10^{-10}$ sec
160 keV level in I^{131}: $T_{1/2} = (9 \pm 1) \times 10^{-10}$ sec
279 keV level in Tl^{203}: $T_{1/2} = (1.2 \pm 0.3) \times 10^{-10}$ sec

Theoretical points of view about these l-forbidden ($\Delta l = 2$, $\Delta j = 1$) M1 transitions are briefly reviewed and it is shown that the matrix elements derived from the experimental half lives are in reasonable agreement with expectations based on the spin-orbit coupling encountered in the shell model. A.

539.152.1 : 538.222

7617. METHOD OF POLARIZING NUCLEI IN PARAMAGNETIC SUBSTANCES. G.Feher.
Phys. Rev., Vol. 103, No. 2, 500-1 (July 15, 1956).

Suggests a scheme for increasing the polarization of nuclear energy levels by a rapid change of the external field H

pplied to the system which is placed in a microwave field and radio-frequency field both perpendicular to H; the sweep lters the occupation of the levels. E.P.Wohlfarth

539.152.1 : 538.222

518. POLARIZATION OF PHOSPHORUS NUCLEI IN SILICON. G.Feher and E.A.Gere.
hys. Rev., Vol. 103, No. 2, 501-3 (July 15, 1956).

The scheme proposed in the preceding abstract was verified by electron spin resonance experiments, the resonance ine amplitude giving a measure of the occupation of the nuclear energy levels. E.P.Wohlfarth

539.152.1

619. EXCITED STATES OF S^{34}. G.S.Stanford and .F.Pieper.
hys. Rev., Vol. 103, No. 3, 637-42 (Aug. 1, 1956).

The mode of decay of the second excited state of S^{34} has een examined, using a "slow-fast" coincidence technique to xamine the gamma-rays in coincidence with the appropriate roton group from the reaction $P^{31}(\alpha,p)S^{34}$. By comparing the bserved cascade to cross-over intensity ratio with that calulated from the Weisskopf lifetime relationships, the number f possible spin-parity combinations for the first and second xcited states can be restricted. When the results of beta-ecay studies are taken into account, it can be inferred that he first two excited states of S^{34} are both 2+. Spin 0+ for the round state is assumed. New measurements of the energies f the low-lying excited states of S^{34} are reported. It is concluded that there are levels at 2.13±0.02, 3.33±0.05, 4.32±0.08, nd 4.8±0.1 MeV. A.

539.152.1

7620. FIRST EXCITED STATES IN Zr^{92} AND Zr^{94}. G.L.Griffith.
Phys. Rev., Vol. 103, No. 3, 643-5 (Aug. 1, 1956).

Fast neutron inelastic scattering by separated isotopes of Zr was studied by observing the de-excitation gamma-ray spectra. The (926 ± 9) keV photopeak observed with normal Zr scatterers was shown to be produced by two gamma-rays differing in energy by less than 2.5% and originating in the isotopes Zr^{92} and Zr^{94}. This is interpreted as evidence for a first excited state at about 926 keV in both isotopes. Relative excitation curves for gamma-ray production by neutron inelastic scattering have been measured from threshold to E_n = 5.5 MeV for the 850 keV gamma-ray from Fe^{56} and the 926 keV gamma-rays from Zr^{92+94}. A.

539.152.1

7621. ALPHA-PARTICLE MODEL OF C^{12}. A.E.Glassgold nd A.Galonsky.
Phys. Rev., Vol. 103, No. 3, 701-3 (Aug. 1, 1956).

The α-particle model for C^{12} has been re-examined. In ddition to correlating the 0^+, 2^+, and 0^+ states at 0, 4.43 and 7.65 MeV, respectively, two possible identifications are given or the 9.61 MeV level: 1^- or 2^+. These levels completely letermine the model and the position and character of all levels p to 15 MeV are given. The main defect of the model is its rediction of a 3^- state at 5.53 MeV which has never been observed. The separation of the α particles in C^{12} is 3.7 x 10^{-13} cm and the mean zero-point kinetic energy per vibrational legree of freedom is about 2 MeV. A.

539.152.1

7622. NUCLEAR BINDING ENERGIES IN THE SHELL MODEL. I.Talmi and R.Thieberger.
Phys. Rev., Vol. 103, No. 3, 718-20 (Aug. 1, 1956).

Nuclear binding energies are calculated from a general two-body interaction by using jj-coupling shell model wavefunctions for the nucleons. The good agreement obtained indicates that the effective central field in which the nucleons move is the same for all nuclei in which the same shell is being filled. A.

539.152.1

7623. REORIENTATION EFFECT IN COULOMB EXCITATION. G.Breit, R.L.Gluckstern and J.E.Russell.
Phys. Rev., Vol. 103, No. 3, 727-38 (Aug. 1, 1956).

The semiclassical treatment of the effect of the reorientation of the spin of the target nucleus during a collision resulting in Coulomb excitation is presented. It is found that the effect vanishes for zero excitation, but that it may be appreciable for finite excitation. The effect on the angular distribution of the photons is similarly found to vanish for head-on collisions. Three different types of experiments involving the measurement of the angular distribution of the photons are discussed. Typical numerical results for comparison with experiment are presented and the possibilities offered by bombardment with heavy ions are noted. A.

539.152.1

7624. MAGNETIC ANALYSIS STUDY OF THE ENERGY LEVELS OF THE S^{33} NUCLEUS. L.M.Khromchenko.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 681-5 (1956). In Russian.

The magnetic analysis method was used to investigate the energies of the protons obtained in the S^{32} (d, p) S^{33} reaction. Twenty one proton groups were recorded of which one corresponds to the ground state and the others to 20 excited levels of the S^{33} nucleus. Excitation energies up to 9.2 MeV were investigated. Besides the 12 excited levels previously known 8 new levels at high excitation energies were detected. A.

539.152.1

7625. APPLICATION OF MAGNETIC ANALYSIS OF THE PRODUCTS OF (d, p) REACTIONS FOR INVESTIGATION OF THE QUANTUM CHARACTERISTICS OF FINAL NUCLEAR LEVELS. Yu.A.Nemilov and V.F.Litvin.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 686-9 (1956). In Russian.

The parity and possible values of the spins of the nuclear levels of Al^{27} obtained from the Al^{28} (d, p) Al^{28} reaction were determined by comparing the relative intensities of proton groups emitted at a given angle for various energies of the primary particles (deuterons). The following results for the excited levels of the Al^{28} nucleus were obtained: parity (+) and spin 0, 1, 4 or 5 for 1.625 MeV energy; parity (−) and spin 0 for 5.128 MeV and parity (−) and spins from 1 to 4 for 5.435 MeV. A.

539.152.1 : 539.165

NUMERICAL VALUES OF THE CONSTANT OF THE TRIPLET BETA-INTERACTION. See Abstr. 6871

539.152.2

7626. INVESTIGATION OF MAGNETIC MOMENTS OF ATOMIC NUCLEI. P.S.Faragó, M.Gécs and J.Mertz.
Nuovo Cimento (Ser. 10), Vol. 2, No. 5, 1110-13 (Nov., 1955).

The moments of F^{19}, Na^{23} and P^{31} were remeasured by the resonance method previously described (Abstr. 10423/1954) with a more homogeneous magnetic field. Results are now in agreement with accepted values. L.Pincherle

539.152.2

7627. EFFECT OF CENTRE-OF-MASS MOTION ON NUCLEAR MOMENTS. J.P.Elliott and T.H.R.Skyrme.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 164-5 (July, 1956).

The value of the magnetic moment, given by Lipkin, de Shalit and Talmi (Abstr. 3084/1956), for a nucleus whose shell model description has one nucleon outside a core, is in contradiction with a general result found by the authors. The discrepancy appears to arise from incomplete antisymmetrization of the wave function. P.T.Matthews

539.152.2

7628. THE SPIN OF THE 2.9 MeV STATE OF Be^8. A.J.F.Boyle.
Nuclear Physics, Vol. 1, No. 8, 581-4 (July, 1956).

The spin of the 2.9 MeV state of Be^8 has been determined by an angular correlation measurement between the direction of emission of the 14.8 MeV γ-rays and the corresponding α-particles arising from the state formed in the reaction $Li^7(p\gamma)Be^{8*}(\alpha)He^4$. It is found to be 2 and the results also show that the γ-transition from the 17.6 MeV 1^+ state to the 2^+ state is a mixture of M1 and E2 radiations. A.

539.152.2

7629. MAGNETIC MOMENT OF THE SECOND EXCITED STATE OF F^{19}. K.Sugimoto and A.Mizobuchi.
Phys. Rev., Vol. 103, No. 3, 739-40 (Aug. 1, 1956).

The magnetic moment of the second excited state (200 keV) of F^{19} was deduced from the change, caused by a magnetic field, in the angular distribution of the de-excitation radiation following (p, p') by F^{19}. The Lamor precession of the excited nucleus displayed in the angular distribution and the rotational change of the angular distribution was measured as a function of the magnetic field strength. If one disregards the influences of the surrounding atoms, the apparent value of the magnetic moment was deduced as $\mu(F^{19*}, 5/2^+) = +(3.0 \pm 0.7)\mu_N$. If one considers these effects, the value obtained gives a lower limit. A.

539.152.2 : 538.222

7630. NUCLEAR SPINS AND MAGNETIC MOMENTS OF ^{161}Dy, ^{163}Dy, ^{171}Yb AND ^{173}Yb. A.H.Cooke and J.G.Park.
Proc. Phys. Soc. A, Vol. 69, Pt 3, 282-3 (March, 1956).

From the electron resonance spectra of the acetates diluted with the Y salt the following nuclear properties were obtained. For Dy^{161} $I = 5/2$, $|\mu| = 0.38 \pm 0.05$ n.m., for Dy^{163} $I = 5/2$ and $|\mu| = 0.53 \pm 0.05$ n.m. and $|^{163}\mu/^{161}\mu| = 1.41 \pm 0.02$. Similarly for Yb^{171} $I = 1/2$ $|\mu| = 0.43 \pm 0.05$, for Yb^{173} $I = 5/2$ and $|\mu| = 0.60 \pm 0.05$ with $|^{173}\mu/^{171}\mu| = 1.39 \pm 0.01$. D.H.Whiffen

539.152.2

7631. NUCLEAR SPINS AND MAGNETIC MOMENTS OF COBALT 56 AND 57. J.M.Baker, B.Bleaney, P.M.Llewellyn and P.F.D.Shaw.
Proc. Phys. Soc. A, Vol. 69, Pt 4, 354-5 (April, 1956).

Paramagnetic resonance experiments show that for Co^{56} $I = 4$ and $\mu = 3.848 \pm 0.015$ n.m., and confirm the earlier values of $I = 7/2$, $\mu = 4.65 \pm 0.05$ n.m. for Co^{57}. M.A.Grace

539.152.2 : 535.34.07

NUCLEAR INDUCTION SPECTROMETER FOR USE AT HIGH RF INTENSITIES AND LOW TEMPERATURES. See Abstr. 6515

539.152.2 : 536.581.3 : 535.34.07

MULTIPLE TARGET NUCLEAR MAGNETIC RESONANCE CRYOSTAT. See Abstr. 6516

539.153

7632. CALCULATION OF THE ELECTRON DISTRIBUTION IN THE HYDROGEN ATOM FOR DIFFERENT VALUES OF THE TEMPERATURE FACTOR. T.R.R.McDonald.
Acta. cryst., Vol. 9, Pt 2, 162-8 (Feb., 1956).

Tables are presented showing the effect of thermal vibration on the electron distribution in the hydrogen atom, both in three dimensions and in projection. The calculations, which were performed on the EDSAC, are based upon the assumption that the charge density in a stationary atom is adequately represented by the square of the normalized (1s) wave-function. In the three-dimensional case, $\rho(r)$, the electron density in a vibrating atom, and n(R), the fraction of the electron contained within a sphere of radius R measured from the centre of the atom, can be expressed explicitly as functions of the temperature parameter B. It is found that the atom is quite diffuse, a sphere of radius 1.0 A, for example, containing only about 70% of the electron. In view of this, due care must be taken in interpreting the results of electron counting on electron-density maps computed from X-ray diffraction data. The magnitudes of the errors introduced by termination of the Fourier series are also discussed. The results of these calculations agree reasonably well with recent measurements of the electron density. It is tentatively concluded that the electron distribution in hydrogen atoms bonded to carbon, nitrogen or oxygen, or weakly hydrogen-bonded to nitrogen or chlorine, is adequately approximated by the electron distribution in an isolated atom. A.

539.153

7633. REDETERMINATION OF THE HYPERFINE SPLITTING IN THE GROUND STATE OF ATOMIC HYDROGEN. J.P.Wittke and R.H.Dicke.
Phys. Rev., Vol. 103, No. 3, 620-31 (Aug. 1, 1956).

A microwave absorption technique was used employing a resonance line with a width of about 3 kc/s. This width (occasionally as narrow as $\frac{1}{10}$ of the normal Doppler breadth) was obtained through the mechanism of collision reduction of the Doppler effect. The primary relaxation mechanism was electron exchange between hydrogen atoms. The measured result for the hyperfine splitting is $\Delta\nu = 1420.40580 \pm 0.00006$ Mc/s. A.

539.153

7634. THE 1s–2s EXCITATION OF HYDROGEN BY ELECTRON IMPACT. B.H.Bransden and J.S.C.McKee.
Proc. Phys. Soc. A, Vol. 69, Pt 5, 422-5 (May, 1956).

The exact solutions are found numerically and compared with the distorted wave results of Erskine and Massey (Abstr. 5996/1952) and the variational results of Massey and Moiseiwitsch (Abstr. 5664/1953). G.E.Brown

539.153 : 539.18

7635. ON THE ANOMALOUS L-X-RAY YIELD IN LIGHT MESIC ATOMS. M.Demeur.
Nuclear Physics, Vol. 1, No. 7, 516-29 (June, 1956).

The properties of a cascade with $\Delta n = 1$ and $\Delta l = \pm 1$ are investigated. It is shown that, if the initial distribution is a statistical one [i.e. proportional to $(2l + 1)$], accumulation occurs in the states of intermediate angular momentum. Application is made to the case of π-carbon, starting with a statistical distribution on the states $n = 17$. A.

539.155.2 : 539.16.08

7636. THE DOSIMETRY OF TRITIUM IN TRITIATED WATER. A.Finkelstein and M.Lesimple.
J. nuclear Energy, Vol. 2, No. 2, 101-9 (Dec., 1955). In French.

A simple determination has been developed, using the reaction of tritiated water on calcium carbide, and counting the acetylene formed in a calibrated ionization chamber. No memory effects have been observed; a slight isotopic separation was detected and estimated. A.

539.155.2

7637. ENRICHMENT OF HEAVY WATER BY A BIOLOGICAL METHOD. L.Carlbom, R.Skjöldebrand and N.Nielson.
Nature (London), Vol. 177, 988 (May 26, 1956).

By the first water percolation of barley in malt production, enrichments of 4 times have been obtained for 9 percolations. J.M.Hough

539.155.2

7638. AN INVESTIGATION OF THE ISOTOPIC CONSTITUTION OF BORON. V.Shyuttse.
Zh. éksper. teor. Fiz., Vol.29, No. 4(10), 486-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 402-5 (May, 1956).

In mass-spectrometer measurements of the isotopic constitution of boron (the compounds of boron were ionized with an electron beam), an effect was observed which depended upon the isotopic distribution. The resulting investigation of this

ffect showed that during the evaporation of the boron compounds from a platinum oven, vapours of the heavy isotope appeared preferentially, which is an effect opposite to that which hould be observed during an ideal evaporation. It was found nat in the preparation of gaseous and solid boron compounds similar separation of the isotopes occurs with the same sign or the separation coefficient. The influence of the indicated istribution effect on the accuracy of the determination of the sotopic constitution of boron was investigated. A.

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.16.08

7639. QUANTITATIVE ESTIMATION OF ACTINIUM BY ITS ACTIVE DEPOSIT. M.Perey and A.Hettler.
C.R. Acad. Sci (Paris), Vol. 242, No. 21, 2552-5 (May 23, 1956). In French.

The active deposit is co-precipitated with Pb as PbS and the activity measured either with a β-particle ionization chamber or a G.M. bell-counter; the sensitivity is about 0.01 μC. Details of the chemical manipulations are given. A.O.Stanesby

539.16.08

7640. AUTOMATIC SCANNING DEVICE. L.W.Holm.
Rev. sci. Instrum., Vol. 27, No. 6, 370-4 (June, 1956).

The driving mechanism and the control and recording circuits of an automatic device for repeated, continuous, unidimensional scanning of radioactive objects are described. The scanner can run at several different speeds from 4.10×10^{-3} up to 1.32 mm/sec. It is shown theoretically and illustrated with actual examples that it is possible to construct "equilibrium curves", i.e., curves corresponding to an infinitely low scanning speed, from those recorded with finite scanning speeds. A.

539.163 : 539.172.4

7641. FORMATION OF AN ISOMERIC STATE OF Zn^{67}_{30} BY MEANS OF SLOW NEUTRON BOMBARDMENT.
J.Montes Ponce de Leon and C.Sánchez del Río.
An. Real Soc. Españ. Fís. Quím., Vol. 52 (A), No. 5-6, 137-9 (May-June, 1956). In Spanish.

The identification of this state by a new method is briefly described. Isotopes Zn^{66} and Zn^{67} being both stable, the capture of slow neutrons by Zn^{66} leads sometimes to the formation of the isomeric state of Zn^{67}; the state has been identified by its 85 μsec half-life measured by means of delayed coincidences between the capture and the isomeric gamma-rays. J.J.Phipps

539.163.1

7642. NEW DETERMINATION OF THE DIFFERENCE IN THE PERIODS OF METALLIC Be^7 AND Be^7F_2. R.Bouchez, J.Tobailem, J.Robert, R.Muxart, R.Mellet, P.Daudel and R.Daudel.
J. Phys. Radium, Vol. 17, No. 4, 363-5 (April, 1956). In French.

The decay constants (λ) of Be^7 in the metallic state and as amorphous BeF_2 were compared over 80 days using a balanced ionization chamber arrangement. A value for $[\lambda(Be^7) - \lambda(Be^7F_2)]/\lambda$ of $1.2 \pm 0.1 \times 10^{-3}$ was obtained. M.A.Grace

539.163.1

7643. A MEASUREMENT OF THE HALF-LIFE OF PU^{241}. B.Rose and J.Milsted.
J. nuclear Energy, Vol. 2, No. 4, 264-76 (June, 1956).

By studying the growth of the gamma activity of the daughter Am^{241} in a xenon-filled proportional counter, a value of 12.95 ± 0.28 years was obtained. A.

539.163.1 : 539.172.4

7644. HALF-LIVES AND NEUTRON CAPTURE CROSS SECTIONS OF THE HEAVY PLUTONIUM ISOTOPES.
J.P.Butler, T.A.Eastwood, T.L.Collins, M.E.Jones, F.M. Rourke and R.P.Schuman.
Phys. Rev., Vol. 103, No.3, 634-7 (Aug. 1, 1956).

Specific alpha activities have been obtained for Pu^{240} and Pu^{242} corresponding to half-lives of 6600 ± 100 years and $379\,000 \pm 5000$ years, respectively. A half life of $(7.5 \pm 2) \times 10^7$ years has been obtained for Pu^{244} by separating uranium daughters. The irradiation of a sample of Pu containing Pu^{244} gave a neutron capture cross-section of 2.1 ± 0.3 barns for Pu^{244} and yielded 10.6 ± 0.4 hr Pu^{245} and its 124 ± 1 min Am^{245} daughter. A.

539.163.1

7645. THREE-MILLIMICROSECOND METASTABLE STATE IN Pb^{209}. D.Strominger, F.S.Stephens, Jr and J.O.Rasmussen.
Phys. Rev., Vol. 103, No. 3, 748-50 (Aug. 1, 1956).

Coincidence studies of radioactive isotopes in the Ac^{225} decay chain were made. A metastable state of Pb^{209} with a half-life of (3.1 ± 1.0) millimicroseconds was observed. This delay following beta-decay of Tl^{209} to Pb^{209} is exhibited by a 120 keV E1 gamma transition and other gamma transitions succeeding the 120 keV gamma transition. Upper limits are set for the lifetimes of several other gamma transitions present in the Ac^{225} chain. An explanation for the delayed nature of this 120 keV E1 transition is given in terms of parentage overlap. Some unusual features of the beta-decay rates of Tl^{209} to Pb^{209} are discussed. A.

539.163.1

7646. HALF-LIVES OF SHORT-LIVED ACTIVITIES WITH A PULSED NEUTRON SOURCE AND A TEN CHANNEL TIME ANALYSER. N.Veeraraghavan.
Proc. Indian Acad. Sci. A, Vol. 43, No. 5, 319-26 (May, 1956).

The half-lives of He^6 and Pb^{207m} have been measured by pulsing the neutron source from a 1 MeV cascade generator and observing the decay with a ten channel cathode-ray-tube time analyser. A scintillation counter with anthracene crystal served as the detector. Using least squares fitting, the half-lives of He^6 and Pb^{207m} were found to be respectively 0.852 ± 0.016 and 0.948 ± 0.014 sec. Comparison with previous determinations is given. A.

539.163.1

7647. THE HALF-LIFE OF Sn^{127}. H.Carminatti, I.Fraenz, R.Radicella and J.Rodriguez.
Z. Naturforsch., Vol. 11a, No. 5, 419-20 (May, 1956). In German.

The isotope was obtained by a (n, α) reaction on Te. The half-life was 123 ± 3 min. A.O.Stanesby

539.163.2

7648. RADIOACTIVE DECAY OF RUTHENIUM-95. E.Schalscha.
Nuclear Physics, Vol. 1, No. 7, 481-5 (June, 1956).

Ruthenium 95, produced by a (n, 2n) reaction, was studied by scintillation spectrometry, and the half-life and positron energy were determined by magnetic deflector and absorption measurements in Geiger-Müller beta counters. The isotope decays with a half-life of 1.65 ± 0.05 hr by emission of positrons with a maximum energy of 1.2 ± 0.1 MeV and by electron capture combined with emission of γ-rays of 145, 340, 640 and 1110 keV. Nuclear level schemes are discussed. A.

539.163.2

7649. L/K-CAPTURE RATIO IN ^{153}Gd AND LOW-LYING LEVELS IN ^{153}Eu. A.Bisi, E.Germagnoli and L.Zappa.
Nuclear Physics, Vol. 1, No. 8, 593-602 (July, 1956).

Only one γ-ray, of energy 104 keV, was found to follow the electron capture decay; its K conversion coefficient was $\alpha_K = 0.70 \pm 0.03$. By using the integrating features of the

scintillation spectrometer and by means of coincidence techniques the L- to K-capture ratio for the transition to the excited state of Eu^{153} was obtained. It was found that $P_L/P_K = 0.68 \pm 0.02$ which corresponds to a transition energy $E_0 = 83 \pm 2$ keV. No branching to the ground state was found. A decay scheme is proposed. The disagreement between these results and those obtained by means of Coulomb excitation of Eu^{153} is pointed out and briefly discussed. A.

539.165

7650. ORBITAL ELECTRON CAPTURE IN ^{179}Ta. A.Bisi, L.Zappa and E.Zimmer.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 307-12 (Aug., 1956).

The electron capture decay of Ta^{179} has been investigated. No γ-rays were observed. The P_L/P_K capture ratio was measured and found to be $P_L/P_K = 1.4 \pm 0.4$. The corresponding transition energy is $E_0 = 94^{+9}_{-4}$ keV. By means of a coincidence method the L-fluorescence yield for transition to the L level following the K-capture was measured and found to be $\omega_{LK} = 0.17 \pm 0.02$. A.

539.165.08

7651. COUNTING EFFICIENCY FOR Np^{239} BETA RAYS. L.Wish.
Nucleonics, Vol. 14, No. 5, 102, 104, 106 (May, 1956).

The activity of a sample of Np^{239} was determined absolutely by counting the α-particles from the Pu^{239} daughter and the sample used for the calibration of β-counters. The separation of the Np^{239} from 120 mg irradiated U_3O_8 and the preparation of Np^{239} sources by electro-deposition on Pt is described in detail. R.D.Smith

539.165.1

7652. ON THE β-RADIATION ACTIVITY OF HUMAN BLOOD. A.I.Danilenko.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 683-4 (1956). In Russian.

A mean value of 2.2×10^{-10} curie per 100 cm^3 of blood within a range of $1.45\text{-}3.4 \times 10^{-10}$ curie was obtained. J.M.Hough

539.165.2 : 523.03

BETA PROCESSES AND ASTROPHYSICS. See Abstr. 6295

539.166 : 539.172.13

7653. COMPOSITION OF THE $Li^7(p,\gamma)$ RADIATION BELOW THE 441 keV RESONANCE. J.G.Campbell.
Austral. J. Phys., Vol. 9, No. 1, 156-8 (March, 1956).

The radiation from both thin and thick Li^7 targets has been measured with a single-crystal scintillation spectrometer. The intensity ratio I(17.6 MeV)/I(14.8 MeV) decreases from ~2.0 at resonance to ~0.5 at 200 keV proton energy. J.J.Wilkins

539.166

7654. ON THE γ-RADIATION OF Na^{25}. M.E.Nahmias and T.Yuasa.
J. Phys. Radium, Vol. 17, No. 4, 373-4 (April, 1956). In French.

The 270 keV to 1.6 MeV region of the Na^{25} (60 ± 2 sec) spectrum has been studied by scintillation spectrometer. Lines at 370 ± 10, 580 ± 10 and 975 ± 10 keV were confirmed, with intensities 0.8 : 1.0 : 0.74. Other lines of longer (~10 min) half-life were observed, due to Mg^{27} and Na^{24} contamination. It is pointed out that earlier studies of the Na^{25} spectrum were probably subject to contamination errors. J.J.Wilkins

539.166

7655. PRECISION WAVELENGTH AND ENERGY MEASUREMENTS OF GAMMA RAYS FROM ^{152}Eu, ^{154}Eu, ^{153}Sm AND ^{165}Dy. B.Andersson.
Proc. Phys. Soc. A, Vol. 69, Pt 5, 415-18 (May, 1956).

Measurements with a curved-crystal spectrometer are reported. Values (to 0.01%-0.1% accuracy) are given for the 0.122, 0.245 and 0.344 MeV Eu^{152} lines, the 0.124 MeV Eu^{154} line, the 0.103 MeV Sm^{153} line, and the 0.095 MeV Dy^{165} line. J.J.Wilkins

539.166.08

7656. FAST COMPTON SCINTILLATION SPECTROMETER. P.R.Howland, N.E.Scofield and R.A.Taylor.
Nucleonics, Vol. 14, No. 6, 50-3 (June, 1956).

The spectrometer measures gamma-ray energies in terms of the energy of Compton-recoil electrons in coincidence with their associated gamma-rays Compton-scattered through $150 \pm 25^\circ$. The incident gamma-rays are scattered in a NaI(Tl) crystal and the amplitude of the scintillation pulses produced by the recoil electrons measured in a 20-channel pulse-height analyser. The analyser is gated by pulses produced by the recoil gamma-rays in a second NaI(Tl) crystal shielded from the incident beam. The resolving time of the coincidence circuit is 0.02 μsec. The energy range of the spectrometer is ≅ 0.2 – 1.0 MeV and its efficiency ≅ 10^{-3}. The resolution R (full width at half-height of pulse amplitude distribution divided by mean pulse height) is given by $R = 0.0773\ E_C^{-0.611}$, where E_C is the recoil electron energy. R.D.Smith

539.166.74

7657. PENETRATION OF GAMMA RADIATION FROM A PLANE MONODIRECTIONAL OBLIQUE SOURCE. M.J.Berger.
J. Res. Nat. Bur. Stand., Vol. 56, No. 3, 111-28 (March, 1956).

The penetration of gamma radiation from a plane monodirectional oblique source is solved by the moment method of Spencer and Fano. The novel feature of the treatment is the systematic investigation and exploitation of a function-fitting technique, which consists of approximating the desired radiation-flux function, f(x), by an expression of the form $\Sigma A_n \phi(B_n x)$, the parameters A_n and B_n being determined from the knowledge of the flux moments. A discussion is given of the criteria for the proper choice of the "weight function", $\phi(x)$, and of the accuracy of the fitting procedure. The results of a sample calculation are presented for an 0.66 MeV source in water. A.

539.166.75

7658. AN INVESTIGATION OF THE PHOTOELECTRIC ABSORPTION OF GAMMA-RAYS IN THALLIUM-ACTIVATED SODIUM IODIDE. K.E.Johansson.
Ark. Fys., Vol. 10, Paper 20, 247-78 (1955).

The photoelectric absorption of gamma rays in thallium-activated sodium iodide has been determined in the energy range 0.4-1.3 MeV by one absolute and one relative method through graphical analysis of the pulse height distributions from various isotopes. Corrections were made for electron and K X-ray escape. The measurements were performed with two or more crystals of different sizes to make an extrapolation to zero crystal extension possible. In this way the influence of secondary and higher absorption processes could be eliminated. Then the fraction of the photons primarily absorbed by the photoelectric effect could be obtained. It was also shown that the same result of the extrapolation was reached with both collimated and uncollimated radiation. In the absolute method the photoelectric absorption coefficients were calculated with the aid of the scattering coefficients from the Klein—Nishina formula. In the relative method isotopes with two or more gamma energies of known relative intensities were used. The pulse height distribution curves were analysed graphically. After the above corrections had been made, the ratio between the photoelectric absorption coefficients for two gamma-energies could be calculated. The agreement between the results of the two methods was good. The photoelectric absorption coefficients according to the present investigation are compared with previous theoretical and experimental values. A.

539.166.75

59. ABSORPTION MEASUREMENTS WITH Co^{60} GAMMA ADIATION. L.Keszthelyi.
cta phys. Hungar., Vol. 5, No. 3, 269-74 (1955).

The absorption of Co^{60} gamma radiation was measured in aI, KBr, KCl, NaCl and naphthalene crystals. From the easured absorption the atomic cross-section of absorption as determined for the elements I, Br, K, Cl and Na. The easured and calculated values agree within the experimental rrors. A.

539.166.83

660. ANGULAR CORRELATIONS BETWEEN SUCCESSIVE ONVERSION ELECTRONS IN ^{80}Br. E.Breitenberger.
roc. Phys. Soc. A, Vol. 69, Pt 6, 453-63 (June, 1956).

The angular correlation between the successive K-conersion electrons from the de-excitation of 4.4-hour Br^{80} has een investigated, using anthracene scintillation spectrometers n conjunction with coincidence single-channel kicksorters. isturbing side effects were kept under control by a special rocedure of taking data. The correlation function contains nly a second-order term with $a_2 \cong +0.30$. This is consistent ith the assignment M3/E1, and excludes M3/(M1 + E2). hell theory then makes the intermediate and ground levels of he cascade $f_{5/2}g_{9/2}$ and $p_{3/2}p_{1/2}$, respectively, but cannot account or the isomeric level (which must be 5^-). The experimental nethod used in this work can be applied to other e-e cascades. A.

539.166.832/.835

7661. SCATTERING OF 250 MeV PHOTONS BY FREE ELECTRONS. L.V.Kurnosova, L.A.Razorenov and P.A.Cherenkov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 690-4 (1956). In Russian.

The ratio of the scattering cross-section for 250 MeV photons scattered by free electrons in a beryllium target to the pair production cross-section was measured. The experimental arrangement recorded recoil electrons and pair electrons (positrons) in the energy regions 235-247 and 222-233 MeV. Within the accuracy of the measurements the experimental values of the cross-section ratios agree with the values computed from the Bethe—Heitler formula for the pair production and the Klein—Tamm formula for the Compton scattering. A.

539.166.835

7662. ANNIHILATION OF POSITRONS IN SUPERCONDUCTING LEAD. S.M.Shafroth and J.A.Marcus.
Phys. Rev., Vol. 103, No. 3, 585-8 (Aug. 1, 1956).

A search was made for changes in the two-quantum annihilation rate when positrons are annihilated in superconducting lead compared to normal lead. The change of state was brought about either by turning off or on a magnetic field or by varying the temperature of the sample. The ratio of the two-photon coincidence rate in normal lead to that in superconducting lead was found to be 1.0011 ± 0.0016 in the magnetic field experiment and $1.0003 \pm 0\ 0011$ in the temperature-varying experiment. A.

539.167.3

7663. PREPARATION OF RADIOACTIVE SOURCES BY VAPORIZATION AT HIGH TEMPERATURES. J.Mérinis.
J. Phys. Radium, Vol. 17, No. 3, 308-9 (March, 1956). In French.

A technique for preparing P^{32} as iron phosphate by vacuum evaporation is described, to yield very strong sources. The iron phosphate is heated rapidly by electron bombardment in a molybdenum crucible. J.M.Hough

NUCLEAR REACTIONS 539.17

539.17 : 537.521

7664. RUSSIAN THERMONUCLEAR EXPERIMENTS. I.G.Kurchatov.
Nucleonics, Vol. 14, No. 6, 36-43, 123 (June, 1956).

A reprint, with the original diagrams and photographs, of the lecture abstracted in Abstr. 3974 (1956).

539.17

7665. HELIUM-COOLED LIQUID HYDROGEN-DEUTERIUM TARGET. G.S.Janes, L.G.Hyman and C.J.Strumski.
Rev. sci. Instrum., Vol. 27, No. 7, 527-30 (July, 1956).

A thin-walled liquid hydrogen-deuterium target has been developed which makes use of the boil-off vapours from liquid helium as a coolant. Approximately 3 litres of liquid helium are required to condense the hydrogen and 0.13 litre per hour thereafter. A.

539.172

7666. SEMIEMPIRICAL MODEL FOR DIRECT NUCLEAR BREAKUP REACTIONS. M.Sachs.
Phys. Rev., Vol. 103, No. 3, 671-3 (Aug. 1, 1956).

A semiempirical model describing the direct breakup of light nuclei by low-energy nucleons is proposed. The model is based upon the assumption that a statistical equilibrium is established with respect to the incident particle and $(\nu - 1)$ tightly bound subgroup components of the target nucleus inside of an energy-dependent interaction volume. The interaction volume is taken to be an oblate spheroid which is oriented along the direction of the incident particle path, and which has a minor axis equal to the de Broglie wavelength λ, and a major axis equal to $(R + a\lambda)$, where R and a are parameters characteristic to the particular reaction involved. The direct breakup cross-section is calculated for the $Be^9(n, 2n)Be^8$ and $C^{12}(n, n')3He^4$ reactions. A.

539.172

7667. NUCLEON TUNNELING IN $N^{14} + N^{14}$ REACTIONS. G.Breit and M.E.Ebel.
Phys. Rev., Vol. 103, No. 3, 679-701 (Aug. 1, 1956).

The tunneling process is considered as a partial explanation of observations by Reynolds and Zucker on the reactions $N^{14}(N^{14}, N^{13})N^{15}$ and $N^{14}(N^{14}, C^{13})O^{15}$. The theory of reactions of this type is first formulated in reasonably general terms, employing a classical mechanics treatment of the motion of the colliding nuclei and of the reaction products. The starting point is a set of adiabatic (fixed centres of mass of heavy aggregates) wave-functions, which is transformed to a related system of functions insuring a better intitial convergence of the iteration procedure. The anisotropy of transfer inherent in the p-nucleon eigenfunctions is taken into account but finally eliminated by the consideration of extreme j-j coupling shell structure eigenfunction assignments, as well as the spin and statistics of the nuclei. The effect of antisymmetrizing the wave-function with respect to neutrons and protons in the incomplete shells is worked out. The relation of the angular distribution problem presented by the case of dominant Coulomb effects to a popular form of stripping theory is discussed, with the conclusion that the classical dynamics approximation to the motion of the colliding nuclei is adequate. The dependence of the total cross-section on energy and of the differential cross-section on angle, when compared with experiment, indicates the presence of another reaction mechanism participating especially at the lower energies. A.

539.172

7668. THEORY OF REACTIONS WITH POLARIZED PARTICLES. A.M.Baldin and M.I.Shirokov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 784-5 (1956). In Russian.

Transformation theory employing the conservation laws

directly is developed. Expectation values of arbitrary operators are expressed in terms of tensor operators. G.E.Brown

539.172 : 537.311.33 : 538.244.2

175 000 GAUSS MAGNET FOR NUCLEAR-TRACK PLATE WORK WITH 95 MeV SYNCHROCYCLOTRON. See Abstr. 6789

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172.1

7669. COULOMB EXCITATION OF NUCLEI BY HEAVY IONS. A.P.Grinberg and I.Kh.Lemberg.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 807-8 (1956). In Russian.

The ratio of Coulomb excitation of nuclei by heavy ions to that by protons is calculated and curves are given for tantalum and manganese bombarded by nitrogen ions. G.E.Brown

539.172.1

7670. EXPERIMENTAL STUDY OF COULOMB EXCITATION OF NUCLEI BY NITROGEN IONS. D.G.Alkhazov, D.S.Andreev, A.P.Grinberg and I.Kh.Lemberg.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 809-11 (1956). In Russian.

Twenty-one nuclei were bombarded by 15.6 MeV triply-charged nitrogen ions. Energies of off-coming γ-rays are tabulated in a table. For K, Ni, Cu, Sn and Bi no Coulomb excitation was observed. G.E.Brown

539.172.11

7671. EXCITATION FUNCTIONS FOR (α, xn) REACTIONS ON LEAD. W.John, Jr.
Phys. Rev., Vol. 103, No. 3, 704-13 (Aug. 1, 1956).

The excitation functions have been measured. A procedure has been developed for preparing enriched lead isotope targets by evaporation. Stacked foils were bombarded by the alpha-beam of the 60 in. cyclotron. The induced polonium alpha-activities were separated by alpha pulse-height analysis. The measured excitation functions for $Pb^{206} + \alpha$ are compared to the excitation functions for Bi + p. Since the compound nucleus formed is the same, the comparison gives a test of the predictions of Bohr's compound nucleus theory. The ratios of corresponding cross-sections are in agreement with the compound nucleus theory. However, the excitation functions are displaced in energy by an amount not predicted by the theory. The disagreement is just outside of the experimental errors. The comparison of $Ni^{60} + \alpha$ and $Cu^{63} + p$ made by Ghoshal has been checked with more recent mass values, revealing a larger energy discrepancy. The excitation functions for reactions on various lead isotopes are found to be very similar. However, the excitation functions are found to be displaced in energy by an amount not exactly equal to the differences in thresholds. A.

539.172.11

7672. NUCLEAR DISINTEGRATIONS PRODUCED IN NUCLEAR EMULSIONS BY α-PARTICLES OF GREAT ENERGY. M.V.K.Appa Rao, R.R.Daniel and K.A.Neelakantan.
Proc. Indian Acad. Sci. A, Vol. 43, No. 3, 181-201 (March, 1956).

A study of nuclear disintegrations caused by α-particles of primary cosmic-radiation with energies > 5 BeV per nucleon, has been carried out. In a systematic survey in nuclear emulsions using "along the track" scanning method, 479 α-particles with a total track length of 40.84 m and 242 interactions were obtained. From the angular distribution of shower particles associated with these interactions, a procedure has been found for distinguishing protons, which originally formed part of the incident α-particle and which have not taken part in the interaction, from other charged particles. The mean free path for nuclear interaction in G-5 emulsion is found to be 17.5 ± 1.1 cm. (68.9 ± 4.3 g/cm^2). Assigning both to the incident α-particle and to the target nuclei a radius $R = r_0 A^{1/3}$, one obtains an effective nuclear radius $r_0 = 1.13 \pm 0.04 \times 10^{-13}$ cm. Using the number of protons emerging from disintegrations of heavy nuclei (silver and bromine) without having participated in the interaction (as can be deduced from the angular distribution) and assuming spherical nuclei of uniform density, the mean free path of nucleons in nuclear matter is calculated to be less than 3.2×10^{-13} cm. A.

539.172.13 : 539.152.1

7673. EXPERIMENTAL STUDY OF TRANSIENT α-PARTICLE SUB-STRUCTURES IN C^{12}. A.Samman.
C.R. Acad. Sci. (Paris), Vol. 242, No. 18, 2232-4 (April 30, 1956). In French.

Out of 27 disintegrations p(about 340 MeV) + $C^{12} \rightarrow p' + 3\alpha - 7.28$ MeV, in nuclear emulsions, 8 were found to conform to the reaction $p + C^{12} \rightarrow p' + \alpha_1 + (Be^{8*} \rightarrow 2\alpha)$, confirming the existence of transient sub-structures (Cüer et al., Abstr. 3094, 6393/1955). A.O.Stanesby

539.172.13

7674. CROSS SECTIONS OF (p, xn) REACTIONS IN THE ISOTOPES OF LEAD AND BISMUTH. R.E.Bell and H.M.Skarsgard.
Canad. J. Phys., Vol. 34, No. 8, 745-66 (Aug., 1956).

Measurements have been made by the activation method of cross-sections of (p, xn) reactions in Bi^{209}, Pb^{206}, Pb^{207} and Pb^{208}. The present results cover $x = 3$ to 7 in Bi^{209}, 2 to 6 in Pb^{206}, 2 to 4 in Pb^{207} and 3 and 4 in Pb^{208}, over a total proton energy range from 12 to 85 MeV. The absolute accuracy is about 15%. Each cross-section plotted as a function of proton energy rises above its threshold to a peak whose height is of the order of one barn, and then falls again to a low and fairly constant value. The results from $x = 3$ to 7 are consistent with a compound nucleus plus prompt nucleon—nucleon cascade model using reasonable nuclear parameters, but the experimental (p, 2n) cross-section appears to be almost double the value so predicted. Since (p, xn) reactions are dominant in the energy range 10 to 40 MeV, their sum approximates the total reaction cross-section; the experimental sum fluctuates around the smooth curve computed for the compound nucleus model with $r_0 = 1.3 \times 10^{-13}$ cm. The fluctuations are similar to, but more marked than, those in the total neutron cross-section of heavy elements in the same energy range. A more detailed theoretical discussion of these results is given by Jackson (abstract following). A.

539.172.13

7675. A SCHEMATIC MODEL FOR (p, xn) CROSS SECTIONS IN HEAVY ELEMENTS. J.D.Jackson.
Canad. J. Phys., Vol. 34, No. 8, 767-79 (Aug., 1956).

See also preceding abstract. A schematic model for the description of (p, xn) reactions in heavy elements is presented. Reactions are divided into two steps, a prompt multiple collision process, followed by an evaporation stage. The various prompt processes are given by the results of Monte Carlo calculations, while the evaporation processes are described by a simplified model assuming constant nuclear temperatures and only neutron evaporation. The resulting (p, xn) and to a minor degree (p, pxn), cross-sections are compared with the experimental data of Bell and Skarsgard (1956) in the energy range up to 100 MeV. With an average neutron binding energy of around 7.3 MeV, a nuclear temperature of about 1.8 MeV, and a nuclear radius of 8.0×10^{-13} cm, a reasonable over-all fit can be made to the data for Pb^{206}, Pb^{207}, Pb^{208} and Bi^{209}. Characteristic fluctuations in the experimental results for the (p, 2n), (p, 3n) and (p, 4n) reactions for all targets seem to be attributable to variations in the total reaction cross-section, and are not reproduced by the present model. A.

539.172.13

676. FISSION OF URANIUM WITH 170 MeV PROTONS. .Kjelberg and A.C.Pappas.
uclear Physics, Vol. 1, No. 5, 322-5 (1956).

The formation cross-section of 22 products formed in ssion and spallation of natural uranium with 170 MeV protons ave been measured. The integrated fission cross-section is etermined to (1.9 ± 0.3) barn. Improved half-lives are eported for Sr^{89} and Ni^{66}, respectively (51 ± 1) d and 54.8 ± 0.3) hr. The energy of the β-particles from Ni^{66} is etermined to 0.15 MeV. A.

539.172.13

677. RADIOCHEMICAL STUDIES OF THE INTERACTION)F LEAD WITH PROTONS IN THE ENERGY RANGE 0.6 TO .0 BeV. R.Wolfgang, E.W.Baker, A.A.Caretto, J.B.Cumming, .Friedlander and J.Hudis.
hys. Rev., Vol. 103, No. 2, 394-403 (July 15, 1956).

Lead targets have been bombarded with protons of several nergies between 0.6 and 3.0 BeV and formation cross-sections ave been determined for about 30 nuclides of $A < 140$ produced n these bombardments. The excitation functions, both for the ightest products studied ($A < 35$) and for neutron-deficient arium isotopes, rise steeply with increasing energy. For ntermediate mass products ($50 < A < 120$), the changes in nformation cross-sections with increasing energy are much maller and may largely be interpreted as a shift towards more eutron-deficient products and as a broadening of the yield-nass distribution. At 3 BeV the spallation and fission product egions have merged, and the cross-sections for forming all nass numbers below the target mass are equal within an order f magnitude. The changes in yield pattern above about 0.4 BeV re shown to be associated with increasing probabilities of very large energy transfers (of the order of 1 BeV) from the ncident proton to the struck nucleus, and this trend is ex-lained in terms of an energy transfer mechanism involving the roduction, scattering and reabsorption of pions. Besides the well-known modes of de-excitation — particle evaporation spallation) and fission — a new mode termed fragmentation s postulated to account for some of the observed products, especially the light fragments. Fragmentation is thought to be associated with the short mean free paths of pions in nuclear matter which cause local heating and can thus lead to disso-ciation of the nucleus into fragments in a time short compared to that required for equipartion of energy. A.

539.172.13

7678. TEST OF THE STATISTICAL ASSUMPTION IN NUCLEAR REACTIONS. R.M.Eisberg and N.M.Hintz.
Phys. Rev., Vol. 103, No. 3, 645-6 (Aug. 1, 1956).

The angular distribution of protons inelastically scattered from A^{40}, leading to the excitation of the 1.47 MeV level, has been measured at bombarding energies of 9.8, 9.0 and 8.5 MeV. An attempt is made to relate these data to the possibility of correlations in the phases of the levels excited in the compound nucleus. A.

539.172.13

7679. Q-VALUE MEASUREMENTS FOR PHOSPHORUS AND CHLORINE. D.M.Van Patter, C.P.Swann, W.C.Porter and C.E.Mandeville.
Phys. Rev., Vol. 103, No. 3, 656-61 (Aug. 1, 1956).

Targets containing phosphorus and chlorine have been bombarded by protons accelerated by the ONR-Bartol Van de Graaff generator. Charged particles from nuclear reactions have been analysed at 90% by using a 180° double-focusing magnetic spectrometer. The following ground-state Q-values have been determined: $P^{31}(p, \alpha)Si^{28}$, Q = 1.911 ± 0.005 MeV; $Cl^{35}(p, \alpha)S^{32}$, Q = 1.851 ± 0.007 MeV; $Cl^{37}(p, \alpha)S^{34}$, Q = 3.015 ± 0.011 MeV. The following level positions have been measured: P^{31}, 1.264 ± 0.004 MeV; S^{34}, 2.129 ± 0.014 MeV; Cl^{35}, 1.219 ± 0.005 MeV and 1.760 ± 0.004 MeV. At E_p = 3.055 MeV, a survey was made for inelastic proton groups from P^{31} corresponding to levels from 0 to 1.43 MeV excitation. Only one group (Q = −1.264 MeV) was observed; no other groups were observed with an intensity greater than 15% of the intensity of this group. A.

539.172.13

7680. EXCITED STATES IN B^{10}. J.B.Marion.
Phys. Rev., Vol. 103, No. 3, 713-17 (Aug. 1, 1956).

Energy levels in B^{10} have been investigated by observing the neutrons from the $Be^9(p, n)B^9$ reaction and the γ-rays from the $Be^9(p, \alpha\gamma)Li^6$ reaction in the range of bombarding energy from 2 MeV to 5 MeV. At $E_p = 2.562 \pm 0.006$ MeV both the neutrons and the γ-rays are resonant. The width of the γ-ray peak is 38 ± 3 keV while the width of the neutron peak is 85 ± 10 keV. The results are analysed in terms of two B^{10} states at 8.89 MeV which probably are the analogues to the 7.37 and 7.54 MeV states in Be^{10}. The neutron reduced widths for the B^{10} states are in good agreement with those for the Be^{10} states (which is to be expected on the basis of charge symmetry of nuclear forces) if the neutron and γ-ray resonances have $J = 3^+$, $T = 1$ and $J = 2^+$, $T = 1$, respectively. In addition, a broad resonance in the neutron yield at $\theta = 90^0$ near 3.2 MeV indicates a wide level ($\Gamma \cong 0.7$ MeV) in B^{10} at 9.5 MeV. Angular distributions of the neutrons have been measured and total cross-sections obtained at bombarding energies of 2.56, 2.92, 3.06, 3.56 and 4.56 MeV. A.

539.172.13

7681. EXCITATION CURVE FOR THE REACTION $^{10}B(p, \alpha)\,^7Be$. H.R.Allan, M.Govindsee and N.Sarma.
Proc. Phys. Soc. A, Vol. 69, Pt 4, 350-1 (April, 1956).

The yield of ground state α-particles at 46° to the proton beam (0.8-1.8 MeV) shows evidence for resonances at 1.1 MeV ($\Gamma > 300$ keV) and 1.5 MeV ($\Gamma \sim 200$ keV). Possible assignments of spin and parity to the compound states are discussed. M.A.Grace

539.172.13

7682. THE YIELD AND ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTION $^{63}Cu(p, n)\,^{63}Zn$ AT 18 MeV. D.M.Thomson.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 447-52 (June, 1956).

The yield of neutrons from the reaction $Cu^{63}(p, n)\,Zn^{63}$ at 18 MeV has been measured at five angles to the incident proton direction, using nuclear emulsions to detect the neutrons. The anisotropic angular distributions, which show some preference for the forward direction, and the shape of the neutron energy spectrum, provide some further evidence that the statistical compound nucleus model does not completely account for reactions of this type. The total (p, n) cross section was estimated to be 2×10^{-25} cm², in agreement with the value found by Ghoshal at this energy. A.

539.172.13

7683. THE PROTON – γ ANGULAR CORRELATION IN THE REACTION $^{10}B(d, p)\,^{11}B$. S.Gorodetzky, A.Gallmann, M.Croissiaux and R.Armbruster.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2545-6 (May 23, 1956). In French.

The angular correlation for the 2.14 MeV level in B^{11} was measured in the plane perpendicular to the deuteron beam. At a deuteron energy of 1.2 MeV this is isotropic to within 3.5%. It is suggested that the level has $I = \frac{1}{2}$. M.A.Grace

539.172.13

7684. EXCITATION CURVES OF THE REACTION $^{16}O(d, p)\,^{17}O^*$. M.Roclawski-Conjeaud and E.Cotton.
Nuclear Physics, Vol. 1, No. 8, 603-9 (July, 1956). In French.

Excitation curves of the reaction $O^{16}(d, p)\,O^{17*}$ (875 keV level) are given at angles 10° and 135° (in the laboratory system) for deuteron energies between 1.7 and 4.5 MeV. A.

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539.172.13

7685. NEUTRON THRESHOLDS IN THE DEUTERON BOMBARDMENT OF NEON. J.B.Marion, J.C.Slattery and R.A.Chapman.
Phys. Rev., Vol. 103, No. 3, 676-8 (Aug. 1, 1956).

The counter ratio technique has been used to detect neutron thresholds in the deuteron bombardment of neon. Energy levels in Na^{21}, observed in the $Ne^{20}(d,n)Na^{21}$ reaction, were found at 1.46 ± 0.04 and 2.426 ± 0.037 MeV. The latter state is bound by only 26 ± 8 keV from dissociation into Ne^{20} + p and will influence the cross-section for the $Ne^{20}(p,\gamma)Na^{21}$ reaction at low energies. Two additional thresholds were observed which are attributed to the $Ne^{22}(d,n)Na^{23}$ reaction. The neutron yield indicates that for bombarding energies above 2.5 MeV a large fraction of the neutrons from the $Ne^{20}(d,n)Na^{21}$ reaction leave Na^{21} in the excited state at 2.43 MeV. A.

539.172.3

7686. THE EFFECTIVE CROSS-SECTION FOR THE PHOTOFISSION OF THE NUCLEI OF URANIUM AND THORIUM. V.A.Korotkova, P.A.Cherenkov and I.V.Chuvilo.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 4, 633-6 (1956). In Russian.

Gives cross-sections for fission by γ-rays with energies between about 7 and 23 MeV. The cross-sections for both U and Th show a resonance at about 15 MeV, where the cross-sections are 8.7 and 2.6×10^{-26} cm^2 respectively. The cross-sections were deduced on the assumption of a Heitler distribution of γ-ray energies in Bremsstrahlung. The results for U check satisfactorily with those of Haxby et al. (Phys. Rev., Vol. 59, No. 1, 57-62, Jan. 1, 1941), and of Charbonier et al. (Helv. Phys. Acta, Vol. 22, 385, 1949). J.M.Radcliffe

539.172.3

7687. THE ENERGY DISTRIBUTION OF THE FRAGMENTS FROM THE FISSION OF NUCLEI OF THORIUM AND URANIUM BY γ-RAYS. V.A.Korotkova, P.A.Cherenkov and I.V. Chuvilo.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 5, 811-13 (1956). In Russian.

The γ-rays were bremsstrahlung, of energy up to 17.7 MeV. The observed asymmetry is compared qualitatively with that found for fissions induced by the absorption of slow and fast neutrons. J.M.Radcliffe

539.172.3 : 539.18

7688. PRODUCTION OF A NUCLEAR STAR AND A π-MESON BY A γ-RAY. Yu.A.Vdovin.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 782-3 (1956). In Russian.

The process in which a gamma ray creates a π-meson pair and one of the π-mesons is absorbed by the (black) nucleus is considered. G.E.Brown

539.172.3

7689. ON γ-p REACTIONS WITH THE FORMATION OF GROUND-STATE NUCLEI. V.I.Gol'danskiĭ.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 969-71 (1956). In Russian.

Conclusions are drawn about absorption in the region of the giant resonance (15-25 MeV) for B^{10}, C^{12}, N^{14}, O^{16} and S^{32}, from the inverse p-γ reactions. The integral cross-section for formation of the nucleus in the ground state is found to reach ~ 10% of the integrated giant dipole resonance. G.E.Brown

539.172.4

7690. THE CROSS-SECTION FOR AN INELASTIC INTERACTION BETWEEN NUCLEI AND NEUTRONS WITH ENERGIES OF 120 AND 380 MeV. V.I.Gol'danskiĭ, A.A.Koval'skiĭ, V.S.Pen'kina and É.Z.Tarumov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 2, 219-22 (1956). In Russian.

The cross-sections are deduced from measurements of the absorption coefficient. The cross-sections (in units of $\sigma \times 10^{24}\,cm^2$) at 120 MeV were as follows: for C nuclei, 0.186; for Pb, 1.50; for U, 1.68; and at ~ 380 MeV: for Al, 0.258; for Pb, 1.50; for U, 1.56. There is a discussion of attempts to interpret these results by the optical model. J.M.Radcliffe

539.172.4

7691. THE SLOW NEUTRON TOTAL CROSS SECTION OF PLUTONIUM. N.J.Pattenden.
J. nuclear Energy, Vol. 2, No. 3, 187-92 (March, 1956).

The neutron total cross-section of plutonium samples of different isotopic compositions has been measured from 0.0015 eV to 25 eV. The cross-section of Pu^{239} at 0.0253 eV was observed as (1050 ± 30) barns, and a level was observed at (0.300 ± 0.005) eV, with the parameters $\sigma_{to} = (5330 \pm 200)$ barns $\Gamma = (0.101 \pm 0.005)$ eV, and $g\Gamma_n^0 = (1.14 \pm 0.06) \times 10^{-4}$ eV. Other peaks were observed at 7.8 eV, 11.3 eV, and 16 eV. At lower energies, the cross-section varied in a way which could be explained by the existence of a level with parameters $E_r = 0.01$ eV, $\sigma_o\Gamma^2 = 1.6$ barn eV^2 and $g\Gamma_n^0 = 10^{-9}$ eV. A level was observed in the Pu^{240} cross-section, with the parameters $E_r = (1.06 \pm 0.01)$ eV, $\Gamma = (0.029 \pm 0.006)$ eV, and $\Gamma_n^0 = (1.75 \pm 0.4) \times 10^{-3}$ eV. A.

539.172.4

7692. RESONANCE ACTIVATION INTEGRALS OF U^{238} AND Th^{232}. R.L.Macklin and H.S.Pomerance.
J. nuclear Energy, Vol. 2, No. 4, 243-6 (June, 1956).

Resonance activation integrals of 281 ± 20 b for U^{238} and 67 ± 5 for Th^{232} were found by comparing induced beta activities with Au^{197}, the resonance integral for the last being taken as 1513 b. The ratio of the U^{238} to Th^{232} integrals is 4.20 ± 0.16. The specific alpha activity of the alpha groups near 3.98 MeV leads to a half-life of $(1.45 \pm 0.05) \times 10^{10}$ yr for Th^{232}. A.

539.172.4

7693. ON THE RATIO BETWEEN THE ACTIVATION CROSS SECTIONS OF ^{84}Sr AND ^{88}Sr FOR SLOW NEUTRONS. M.Asdente, A.Bisi, E.Germagnoli and L.Zappa.
Nuclear Physics, Vol. 1, No. 6, 420-4 (May, 1956).

Samples of $SrCO_3$, irradiated in a nuclear reactor, have been used to determine the ratio between the activation cross-sections of the two processes $Sr^{84}(n,\gamma)Sr^{85}$ (65 d) and $Sr^{88}(n,\gamma)Sr^{89}$. Methods of absolute β and γ counting have been used for this purpose. The ratio between the two isotopic cross-sections is found to be 318 ± 21, from which an activation cross-section of 1.59 ± 0.11 b can be calculated for the reaction $Sr^{84}(n,\gamma)$ Sr^{85} (65 d), if the value 5×10^{-3} b is assumed for the cross-section of the process $Sr^{88}(n,\gamma)Sr^{89}$. A.

539.172.4

7694. $Li^6(n,\alpha)H^3$ CROSS SECTION AS A FUNCTION OF NEUTRON ENERGY. F.L.Ribe.
Phys. Rev., Vol. 103, No. 3, 741-8 (Aug. 1, 1956).

The total $Li^6(n,\alpha)H^3$ cross-section has been measured absolutely over the range of neutron energies from 0.88 to 14.1 MeV, with errors varying from 11 to 18%. At its low-energy end, the curve $\sigma(E_n)$ joins smoothly with an extension of the curve of earlier data of Blair and Holland, for which the maximum neutron energy was 0.62 MeV. A log-log plot of $\sigma(E_n)$ for the present data shows a variation approximately as E_n^{-1} for the high-energy portion of the curve with a break to greater flatness at the lower energies, resulting in a broad hump in the cross-section curve at about 2 MeV. This hump is believed to be due to competition from deuteron-producing reactions. A.

539.172.4

7695. THE CAPTURE CROSS SECTION OF NEUTRONS BY BORON. C.H.Collie, R.E.Meads and E.E.Lockett.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 464-8 (June, 1956).

The capture cross-section of natural boron for slow neutrons has been measured by a dynamic method, in which the decay constant of neutrons in a water tank was plotted against the concentration of added borax. Samples were compared with a standard boron oxide in GLEEP at the Atomic Energy Research Establishment, Harwell. The result is quoted as $\sigma_B = 760 \pm 3$ barns for the A.E.R.E. sample of natural boron oxide. A.

539.172.4 : 539.152.1

SIMPLE MODEL OF THE Li^6 NUCLEUS AND THE NEUTRON INDUCED REACTIONS ON Li^6. See Abstr. 6829

539.172.4

7696. THE STORAGE OF FISSILE MATERIAL. A.J.Mayne.
J. nuclear Energy, Vol. 2, No. 2, 77-84 (Dec., 1955).

Estimates are obtained for the safe spacing between a given number of similar fissile spheres arranged in a linear, square, or cubic array. These estimates give upper bounds, so that they overestimate the size of the least spacing that is safe. Estimates are also obtained for the number of fissile spheres that may be stored safely in a regular linear, square, or cubic array, with given spacing between spheres. These estimates give lower bounds, so that they underestimate the maximum number that can be stored safely. The assumptions used in these calculations are stated, the chief one being that the probability of direct neutron passage from one sphere to another decreases at least as fast as the reciprocal of the distance between them. Some numerical examples are calculated. General arrays of fissile bodies are also considered briefly. A.

539.172.4

7697. FISSION CROSS-SECTIONS AS A FUNCTION OF NEUTRON ENERGY. I. URANIUM-235. B.T.Price.
J. nuclear Energy, Vol. 2, No. 2, 128-40 (Dec., 1955).

The variation of the fission cross-section of U^{235} has been compared with that of the boron (n, α) cross-section, for neutron energies (E_n) within the range $0.005 \text{ eV} < E_n < 150 \text{ eV}$. The measurements for $E_n < 1$ eV give the relative values of σ_{fiss} to an accuracy of better than 2%. Values are given for the effective fission cross-section of a thin sample in a (dE/E) neutron spectrum, averaged over four energy intervals within the range 0.8 eV to 100 eV. A.

539.172.4

7698. FISSION CROSS-SECTIONS AS A FUNCTION OF NEUTRON ENERGY. II. PLUTONIUM-239 AND PLUTONIUM-241. R.Richmond and B.T.Price.
J. nuclear Energy, Vol. 2, No. 3, 177-86 (March, 1956).

The fission cross-section of Pu^{239} has been compared with the (n, α) cross-section of B^{10} by means of experiments carried out on the BEPO slow-neutron velocity selector, the BEPO single-crystal neutron spectrometer, and the 15 MeV linear accelerator. The measurements covered the neutron energy range 0.007 to 700 eV. Fission resonances were resolved at the following energies: 0.30, 8.0, 11.2, 15.1, 18.3, 22.8 and 26.8 eV. The fission cross-section of a mixture containing Pu^{241} has been compared with the fission cross-section of Pu^{239} over the neutron energy range 0.04 to 0.4 eV, and with the (n, α) cross-section of B^{10} over the range 0.2 to 70 eV. Fission resonances in Pu^{241} were observed at 0.255 ± 0.02 eV and 4.45 ± 0.1 eV. A.

539.172.4

7699. A COMPARISON OF THE AVERAGE NUMBER OF NEUTRONS EMITTED IN FISSION OF SOME URANIUM AND PLUTONIUM ISOTOPES. J.E.Sanders.
J. nuclear Energy, Vol. 2, No. 4, 247-54 (June, 1956).

Measurements of the relative prompt neutron yields per fission of U^{233}, U^{238}, Pu^{239} and Pu^{241} by thermal neutrons are described. A coincidence technique is employed. Absolute values have been determined using a natural uranium spontaneous fission source to calibrate the neutron detector. A.

539.172.4

7700. FISSION NEUTRON SPECTRUM OF U^{235}.
L.Cranberg, G.Frye, N.Nereson and L.Rosen.
Phys. Rev., Vol. 103, No. 3, 662-70 (Aug. 1, 1956).

The neutron spectrum associated with the fission of U^{235} induced by slow neutrons has been remeasured from 0.18 to 12 MeV. Two different experimental techniques were employed in this measurement: (1) the time-of-flight method covering the energy range from 0.18 to 2.7 MeV, and (2) the photographic plate method encompassing the energy range from 0.35 to 12 MeV. The combined results of these measurements fit the relation, $N(E) = Ke^{-E/0.965}\sinh[(2.29E)^{1/2}]$, where N(E) is the neutron flux, E is the neutron energy in MeV and K is a constant. The simpler expression, $N(E) = KE^{1/2}e^{-0.775E}$, also fits the data well for neutron energies below 9 MeV. A.

539.172.4

7701. ABSORPTION OF NEUTRONS BY BLACK CONTROL RODS. H.Hurwitz, Jr. and G.M.Roe.
J. nuclear Energy, Vol. 2, No. 2, 85-100 (Dec., 1955).

One-velocity diffusion theory is used to study the thermal neutron absorption of black control rods of various shapes under the assumption that the slowing-down density is independent of position in the neighbourhood of the rod. If the neutron diffusion length L is large compared to the cross-sectional dimensions of the rod, the absorption of a cylindrical rod of arbitrary cross-section is the same as that of a circularly cylindrical rod having the same equivalent electrical capacity. If the diffusion length is small, the absorption is proportional to L times the effective rod perimeter, which is equal to the actual perimeter plus a correction for each corner equal to L times a function of the external angle at the corner. A general expression for the correction factor is obtained. The accuracy of the expression for the absorption for large and small values of L is tested in the intermediate range by means of variational expressions giving upper and lower limits of the absorption. A.

539.172.4

7702. MINIMUM CRITICAL MASS AND FLAT FLUX.
G.Goertzel.
J. nuclear Energy, Vol. 2, No. 3, 193-201 (March, 1956).

The problem of distributing fuel in a homogeneous moderator region so as to obtain a reactor of minimum critical mass is set up, and a solution is obtained for thermal reactors. The condition for minimum critical mass is found to be constant thermal flux in the region where there is fuel (the core), with the thermal flux never greater than this constant value where there is no fuel (the reflector). It is necessary to solve an integral equation to find the fuel distribution. The size and shape of the core region is determined from this integral equation. An explicit solution is given for the multigroup reactor model. The minimum problem is also considered with certain restrictions, such as confining the core to a given region. Further, the minimum critical mass for U^{235} in light water is computed (with infinite reflector), and found to be 30 per cent less than the corresponding best value for a uniform fuel distribution in the core. A.

539.172.4

7703. SOLUTION OF SOME NUCLEAR REACTOR PROBLEMS BY THE RESISTANCE-NETWORK ANALOGUE METHOD. I. ONE-VELOCITY-GROUP PROBLEMS. G.Liebmann.
J. nuclear Energy, Vol. 2, No. 3, 213-25 (March, 1956).

The known basic equations for core and reflector of a nuclear reactor are briefly discussed, and it is shown how the resistance-network analogue can solve these equations. Several specimen problems, involving either prescribed neutron flux at the boundaries or prescribed neutron currents, are then solved. The eigenvalues κ, determining the critical dimensions, are listed for these problems, and the neutron flux distributions are shown in graphical form. Finally, a problem determined by the total neutron current crossing the

boundary $\int S(\partial\rho/\partial n)d\sigma$ is solved, and the technique used for this is described in detail. A.

539.172.4

7704. TESTING NUCLEAR-PLANT LEAKTIGHTNESS. J.P.Verkamp and S.L.Williams.
Nucleonics, Vol. 14, No. 6, 54-7 (June, 1956).

A critical comparison of the methods of leak-testing applicable to reactor systems. The design of systems and the use of suitable welding techniques to minimize leaks is considered and a typical leak specification and inspection procedure is given. R.D.Smith

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18

7705. REMARKS ON THE CLASSIFICATION OF FUNDAMENTAL PARTICLES. F.Cerulus.
Nuclear Physics, Vol. 1, No. 8, 557-70 (July, 1956).

Starting from a few experimentally observed reactions and the assumed existence of strong, electromagnetic and weak interactions, a correspondence between all fundamental particles and a certain Abelian group is set up, without referring to any details of the interaction. This formalism allows the derivation of the selection rules for the production of hyperons, K-mesons and π-mesons. The weak interactions of K-mesons, pions, muons, and leptons are correctly described by the formalism, and the conservation of light fermions is derived from it. The relation between the rules for the production and those for the decay of the hyperons and K-mesons is explained. A.

539.18

7706. THE θ-MESON AND THE FERMI–YANG HYPOTHESIS. V.I.Karpman.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 781-2 (1956). In Russian.

The consequences of assuming the θ-meson to be a bound system of two hyperons are discussed. G.E.Brown

539.18

7707. BINDING ENERGY OF HYPER-NUCLEI. D.Ivanenko and N.Kolesnikov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 800-1 (1956). In Russian.

Possible mechanisms for binding and stability with respect to decay into lighter hyper-nuclei are discussed. G.E.Brown

539.18

7708. FURTHER MEASUREMENTS ON CHARGED V-EVENTS. W.A.Cooper, H.Filthuth, J.A.Newth and R.A.Salmeron.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 390-409 (Aug., 1956).

The decays of 150 charged V-particles from lead and copper have been observed in a magnetic cloud chamber. Among the slow charged V-events, which are all interpreted as K-mesons, the proportions of the different decay modes are in good agreement with the results given by nuclear emulsions. The evidence agrees with that of other experiments which suggests that an appreciable fraction of the charged V-events with high energy (> 1 GeV) are due to the decays of hyperons. Data on the positive to negative ratio of slow K-mesons are discussed and a partial explanation in terms of the energy dependence of the production cross-section is suggested. Among the 150 events, 3 are most easily interpreted as the decays of K_β-mesons and 1 as the decay of a Σ^+-particle. In addition 10 events are interpreted as the decays of τ-mesons, of which 1 is negative. A.

539.18

7709. ANALYSIS OF ONE HUNDRED BEVATRON τ^+ PARTICLES. R.H.Haddock.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 240-53 (Aug., 1956).

One hundred τ^+ mesons, obtained from nuclear emulsion stacks exposed to the K^+ beam at the Bevatron, are analysed for (a) Q-value of the τ-decay, (b) possible values of the spin-parity of the τ. A Q of 75.13 ± 0.20 MeV is obtained. The corresponding τ mass is $966.5 \pm 0.74\ m_e$. The analyses by Dalitz and Fabri were used to assign possible spin-parity values to the τ. The case of 0– gives the best agreement with the observed energy and angle distributions. A.

539.18

7710. ANALYSIS OF SOME CASES OF ANOMALOUS DECAY OF θ^0 PARTICLES. E.Fridlender (Friedländer).
Dokl. Akad. Nauk SSSR, Vol. 106, No. 6, 989-90 (1956). In Russian.

Anomalous decay of θ^0 particles, the mass of which has been found to be $(596 \pm 36)\ m_e$ and $Q = 23 \pm 18$ MeV, is reported. The statistical method used by the author is discussed and applied to 64 cases of decay of θ^0 particles. G.Martelli

539.18

7711. TWO EXAMPLES OF MESONIC DECAY OF HYPER-FRAGMENTS. P.H.Fowler and K.H.Hansen.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 158-63 (July, 1956).

Fragment (1) emerges from a 4 + 2n star. Decays in flight according to the scheme $^4_2He^* \rightarrow P + P + D + \pi^- + Q$, giving binding energy 1.9 ± 0.6 MeV. Fragment (2) emerges from 19 + 3p star, decays at rest $^5_2He^* \rightarrow {}^3_2He + P + \pi^- + Q$, giving binding energy 2.9 ± 0.5 MeV. The binding energy values indicate that the bound Λ^0 is unrestricted by the Pauli principle. R.H.W.Johnston

539.18

7712. TWO EXAMPLES OF RARE K^+-DECAYS IN EMULSION. R.Cester, T.E.Hoang, M.F.Kaplon and G.Yekutieli.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1471-3 (June, 1956).

In the course of work with emulsion exposed to the cosmotron K^+ beam, two unusual decay-events were observed: (1) $K_{\pi 2} \rightarrow \pi^+ + \pi^0\ (\rightarrow e^+ + e^- + \gamma)$ identified by g* and pβ measurements on the secondaries; (2) τ^+ decay in flight of which the π^- secondary comes to rest enabling the Q-value and mass to be determined (76.8 ± 2 MeV and 495.3 ± 6 MeV respectively). R.H.W.Johnston

539.18

7713. CORRELATION BETWEEN THE PLANES OF PRODUCTION AND DECAY OF Λ^0-PARTICLES. V.I.Karpman.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 963-4 (1956). In Russian.

An elegant formalism employing the density matrix is developed. Results following from the assumption of $j = 3/2$ for the Λ^0 are given and found to be not in disagreement with experiment. G.E.Brown

539.18

7714. MEASUREMENT OF THE MEAN LIFETIME OF μ-MESONS. D.Kiss.
Acta phys. Hungar., Vol. 5, No. 3, 275-94 (1955).

The mean lifetime (τ) of μ-mesons was determined in an iron absorber with a delayed coincidence method. As a result $\tau = 2.14 \pm 0.21$ μsec was obtained. A.

539.18

7715. NOTE ON THE ANGULAR CORRELATION IN THE DECAYS OF HYPERFRAGMENTS. P.Zielinski.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1479-80 (June, 1956).

It is pointed out that, owing to the low binding energies of Λ^0 particles in light hyperfragments, the interactions of the Λ^0 decay products with the residual nucleus may be neglected.

The Λ^0 momentum within the hyperfragment consequently may be estimated, whence also the angle θ between the direction of flight of the Λ^0 and the direction of decay in its own rest-frame. Analysis of sixteen cases indicates a strong backward–forward correlation. This may give spin information.
R.H.W.Johnston

539.18

7716. ANGULAR CORRELATION METHODS FOR DETERMINING THE SPINS OF THE HYPERONS. R.Gatto.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 197-209 (Aug., 1956).

The intrinsic specification of the configuration of a cascade of two body decays — such as $\Xi^- \rightarrow \Lambda^0 + \pi^-$, $\Lambda^0 \rightarrow p + \pi^-$, or $\Sigma^0 \rightarrow \Lambda^0 + \gamma$, $\Lambda^0 \rightarrow p + \pi^-$ — requires a parameter, the distribution of which will reflect the dynamical features of the process. A detailed discussion is given of these distributions and it is shown that when a sufficient number of Ξ^- cascade decays, and, similarly, of Σ^0 cascade decays, will have been collected, the comparison with the theory will furnish information on the spins and parities of the hyperons involved. A.

539.18

7717. SPIN OF THE Λ-PARTICLE. I.Yu.Kobzarev and L.B.Okun'.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 798-9 (1956). In Russian.

The Λ-particle is considered as a π-meson in a bound state of high angular momentum around a nucleon. It is then found that Λ-particles in nuclei (hyper-nuclei) should have a lifetime $10^5 - 10^6$ times less than free Λ's because of absorption of the π-meson by other nucleons, and decays of hyper-nuclei should proceed almost exclusively by such conversion, in contradiction to experiment. G.E.Brown

539.18

7718. EFFECT OF π-π INTERACTION ON HIGH-ENERGY π-p SCATTERING. A.N.Mitra.
Phys. Rev., Vol. 103, No. 3, 752-9 (Aug. 1, 1956).

The object of this paper is to examine the possibility of explaining the second maximum in (π–p) scattering in the framework of the Tamm–Dancoff approximation for (π–p) interaction, by postulating a resonant π–π interaction in the isotopic spin state I = 0 of the π–π system. For this purpose the Tamm–Dancoff method in pseudoscalar theory, as formulated by Dyson and others, is first extended so as to include the effects of a π–π interaction. This is achieved by introducing a Green's function whose form is determined on the assumption of a zero-range π–π interaction in the state I = 0 of the π–π system. The solution of the "modified" integral equation is greatly simplified by assuming the π–p interaction to be weak compared with the π–π interaction (the reasons for which are given). The total inelastic cross-section is then derived by using the unitary property of the S matrix. It is found that the Tamm–Dancoff approximation is unable to explain the (π–p) maximum on the basis of the proposed model. This is contrary to the result derived by other authors, who used the impulse approximation for the interaction of the incident meson with the meson cloud surrounding the nucleon. A.

539.18

7719. ON THE IONIZATION LOSS OF FAST μ-MESONS. G.N.Fowler.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1316-36 (June, 1956).

The fluctuation in the ionization loss of fast μ-mesons due to resonance effects is discussed in detail using a modification of Landau's method. Numerical results for oxygen, neon and other inert gases are compared with experiment and it is concluded that most of the observed large fluctuation can be accounted for when atomic resonance effects are included and the effect of primary excitation loss on the phenomenon is taken into account. A.

539.18

7720. A DIFFUSION CHAMBER STUDY OF VERY SLOW MESONS. IV. ABSORPTION OF PIONS IN LIGHT NUCLEI. P.Ammiraju and L.M.Lederman.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 283-306 (Aug., 1956).

For Pt III, see Abstr. 3274 (1956). The absorption of slow negative pions has been studied in the light nuclei helium, carbon and nitrogen. The dominant reaction in each case has been observed to be: (1) $\pi^- + He^4 \rightarrow p + 3n$; (2) $\pi^- + C^{12} \rightarrow 2\alpha + 1p + 3n$; (3) $\pi^- + N^{14} \rightarrow 3\alpha + 2n$. Prong distributions, proton and alpha spectra have been compiled and compared with the theory of Clark and Ruddelsden. The frequency of α-emission gives strong qualitative support to the α-particle model of nuclear structure. This is supported by the similarity of the proton spectra in reactions (1) and (2). The low average energy of protons in (1) and (2) and of α-particles in (3) supports the two nucleon recoil model in the primary absorption act. In this case (np) initial nucleon states $^3S_1$ are favoured over (pp) states $^1S_0$ in agreement with the inverse reaction — production of mesons in nucleon-nucleon collisions. A.

539.18

7721. THE APPLICATION OF CHARGE INDEPENDENCE TO THE NUCLEAR CAPTURE OF NEGATIVE K-MESONS. M.Koshiba.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 357-68 (Aug., 1956).

The results of the charge independence hypothesis are compared with the existing experimental data on the nuclear capture of negative K-mesons. The comparison of the calculated Σ^-/Σ^+ and π^-/π^+ emission ratios with the experimental ones strongly suggest the dominance of the T = 1 state over the T = 0 state in the primary act. Furthermore, the π^-/π^+ emission ratio is shown to give an estimate of the branching ratio between Σ emission and Λ^0 emission, which is free from the ambiguities due to the secondary absorption of the products of the primary act or due to the difficulties of detecting neutral particles and is only slightly affected by secondary charge exchange scatterings of the product particles. The preliminary value thus determined by using the experimental data thus far available for the π^-/π^+ emission ratio, suggests that Σ emission is more favoured than Λ^0 emission in the primary act. The implications of measuring the positive-to-negative ratio of high energy π-mesons emitted from K^- captures is discussed in some detail and a few experiments are proposed in this connection. A.

539.18

7722. INTERACTIONS OF K^+ MESONS WITH HYDROGEN NUCLEI AT 50 TO 110 MeV. N.N.Biswas, L.Ceccarelli-Fabrichesi, M.Ceccarelli, M.Cresti, K.Gottstein, N.C. Varshneya and P.Waloschek.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1481-5 (June, 1956).

Eleven K–p collisions were found by "along the track" scanning of 124 m of track in emulsion exposed to the Berkeley K^+ beam. A 15° cut-off was imposed. A further 38 m of track (with one scatter) of energy 0-50 MeV was seen in the course of tracing to rest a fraction of the K-tracks in order to estimate π and p contamination. A mean free path for K–p scattering of 11.3 ± 3.4 m is given for 50-110 MeV K^+–p scattering, implying a cross-section 27 ± 8 mb. The angular distribution suggests forward peaking in spite of the poor statistics. R.H.W.Johnston

539.18

7723. INTERACTIONS OF K^- PARTICLES. A.J.Herz, R.M.May, J.H.Noon, B.J.O'Brien and N.Solntseff.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1491-3 (June, 1956).

Continuation of earlier work (Abstr. 3975/1956). In emulsion exposed to the K^- beam the observed π^-/π^+ ratio is used to estimate the ratio Λ^0/Σ for the hyperons produced by K^- absorption in nuclei. This method avoids having to allow for internal conversion of Σ to Λ. A ratio of order unity is

indicated. The interaction length for K^- particles of energy 0-135 MeV was found to be 16.3^{+10}_{-6} cm. R.H.W.Johnston

539.18 : 530.145

LOW ENERGY LIMITS OF PHOTON-NUCLEON AND PION-NUCLEON COLLISIONS. See Abstr. 6379

539.18 : 537.533.8 : 539.172

INELASTIC DIFFRACTION PROCESSES AT HIGH ENERGIES. See Abstr. 6888

539.18 : 539.172.3

7724. DIFFERENTIAL CROSS-SECTIONS FOR PHOTO-PRODUCTION OF POSITIVE PIONS IN HYDROGEN. I. LOW ENERGIES. M.Beneventano, G.Bernardini, D.Carlson-Lee, G.Stoppini and L.Tau.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 323-56 (Aug., 1956).

The cross-sections $\sigma(E_\gamma, \theta)$ for the reaction $\gamma + p \rightarrow n + \pi^+$ have been measured near threshold as a function of photon energy and at four angles. These results combined with previously known data, have given a fairly complete and accurate description of $\sigma(E_\gamma, \theta)$ between the limits $30^0 \leq \theta \leq 180^0$ and $170 \leq E_\gamma \leq 270$ MeV. Writing

$$\sigma(E_\gamma, \theta) = W\{a_0 + a_1 \cos\theta + a_2 \cos^2\theta\}$$

with $W = \eta\omega\{1 + (\mu/E_i)\nu\}^{-1}\{1 + (\mu/E_f)\omega\}^{-1}$ the experimental data indicate that a_0 is constant up to about $E_\gamma \simeq 260$ MeV; and that the three a_i coefficients analysed in terms of S and P waves give a very small spin flipping P-amplitude K. The presumption that the S amplitude E_1 is mainly due to the gauge invariance requirement is definitely not consistent with the data. A discussion based on the Kroll and Rudermann theorem leads to the conclusion that this inconsistency may be eliminated if allowance is made for the contribution of fairly large nucleon recoils. However, it turns out that only the changing sign part of these recoils is really large and apparently so up to terms of order higher than μ/M. The amount of the recoil at threshold is estimated and consequently a value for the ps.pv interaction constant is derived. A.

539.18

7725. MULTIPLE π^0-PRODUCTION IN ANTI-PROTON ANNIHILATION. A.N.Mitra.
Nuclear Physics, Vol. 1, No. 9, 571-80 (July, 1956).

The Feynman–Dyson formalism is applied to the calculation of multiple π^0-production in proton–antiproton annihilation. The calculations are along lines very similar to those recently followed by Gupta. It is found that contrary to the corresponding results of quantum electrodynamics, the cross-section for the multiple production of π^0's begins to decrease only for values of $n > 15$. Since each π^0 decays into two photons almost immediately, the bearing of this result on the Schein event is briefly discussed. A.

539.18

7726. PRODUCTION OF μ-MESON PAIRS BY PHOTONS. G.E.Masek, A.J.Lazarus and W.K.H.Panofsky.
Phys. Rev., Vol. 103, No. 2, 374-7 (July 15, 1956).

Further measurements are reported on the anisotropic component of μ^- mesons from bombardment of an aluminium target by 600 MeV bremsstrahlung. As reported previously (Abstr. 2449/1956), the authors interpret such a forward peaking as evidence for the direct electromagnetic production of muon pairs. Combining their new data with those previously reported, they obtain a value of 1.42 ± 0.34 (standard deviation) for the ratio of the observed negative-muon cross-section to that calculated by assuming the muons to originate as spin-$\frac{1}{2}$ pair fragments from electromagnetic production in the Coulomb field of an aluminium nucleus of finite size. The absolute normalization is believed correct to within a factor of 1.4. However, the theoretical value considers only the contribution from processes leaving the aluminium nucleus in its ground state; inelastic processes could raise the theoretical value by 40%. Measurements carried out with 450 MeV bremsstrahlung yielded a value of μ^- counts at 12^0 relative to those at 23^0 equal to 0.0002 ± 0.0083, while the value observed at 600 MeV is 0.032 ± 0.009 in units of the π^+ counts observed at those two energies. This result makes it very unlikely that the forward peaking observed originates from μ mesons derived from π-μ decay. It is concluded on the basis of these measurements that the process of direct electromagnetic production of muon pairs exists, and that the yield is compatible with the theory outlined. Measurements carried out on a lead target place only an upper limit on the cross-section in lead. This limit (if taken at three standard deviations) gives a value ten times lower than the μ-pair cross-section calculated for a point lead nucleus, but compatible with a nucleus of the accepted nuclear radius. This result makes it very unlikely that muon scattering in the range of momentum transfers near 50 MeV/c could give anomalous results. A.

539.18

7727. PION PRODUCTION IN H AND Be BY 1.0- AND 2.3-BeV PROTONS. L.C.L.Yuan and S.J.Lindenbaum.
Phys. Rev., Vol. 103, No. 2, 404-12 (July 15, 1956).

The energy spectra of positive and negative pions produced in H and Be by 1.0 and 2.3 BeV protons have been observed at 32^0 in the laboratory system. A fast scintillation counter telescope, including a magnet to select momenta, was used to analyse the direct 32^0 beam of particles proceeding from a straight section of the Brookhaven Cosmotron. The pion spectra were transformed to the nucleon–nucleon centre-of-mass system and were observed to be essentially similar in shape to the $\pi^+ + p$ interaction cross-section as a function of energy in the centre-of-mass system. It was concluded that this interaction, which is believed to be due to the formation of a nucleon isobar with angular momentum and isotopic spin = $\frac{3}{2}$, dominates the meson production process in the 1.0 to 2.3 BeV range. The assumption of a model, whereby meson production proceeds through excitation of one or both of the colliding nucleons to this isobar which subsequently decays by pion emission, resulted in a general qualitative explanation of the results, and also gave quantitative π^+/π^- ratios in agreement with these experiments. The Fermi statistical theory was found, in general, to be contradicted by these results. A.

539.18

7728. PHOTOPRODUCTION OF PI-MESON PAIRS. R.E.Cutkosky and F.Zachariasen.
Phys. Rev., Vol. 103, No. 4, 1108-10 (Aug. 15, 1956).

The cross-section for photoproduction of pion pairs from hydrogen has been calculated from the cut-off static theory, assuming the energy is sufficiently low that one of the mesons is produced in an S state, the other in a P state. It is shown that the cross-section for this process can be expressed exactly in terms of the P-wave scattering phase-shifts, provided the S-wave meson–nucleon interactions and the meson–meson interaction can be neglected. The theoretical predictions obtained here are in general agreement with preliminary experimental results. A.

539.18

7729. ON MESON PRODUCTION BY HIGH-ENERGY NUCLEON COLLISIONS. L.v.Lindern.
Z. Naturforsch., Vol. 11a, No. 5, 340-7 (1956). In German.

Meson showers of energy greater than 10^{10} eV produced by cosmic radiation in nuclear emulsions have been examined. Measurements were made on the angular distributions and on the energies of the mesons. The results have been compared with the theoretical predictions of the Fermi and Heisenberg models of multiple production. D.J.Prowse

539.18

7730. SEVERAL CASES OF PRODUCTION OF HEAVY UNSTABLE PARTICLES IN Be ATOMS. N.G.Birger, V.V.Guseva, G.B.Zhdanov, S.A.Slavatinskiĭ and G.M.Stashkov. G.M.Stashkov.

Zh. éksper. teor. Fiz., Vol. 30, No. 3, 590-1 (1956). In Russian.

Using a 30 cm Wilson cloud chamber, production of heavy particles is studied. Three cases of decay in flight are observed; these are classed as one each of Σ^+, Λ^0 and Θ^0. G.E.Brown

539.18

7731. TWO τ-MESONS DETECTED IN PHOTO-EMULSIONS. I.M.Gramenitskiĭ, E.A.Zamchalova, I.M.Podgoretskiĭ, M.I.Tret'yakova and M.N.Shcherbakova.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 967-9 (1956). In Russian.

Energies of all decay π's are well defined and characteristics of both events are given in a table. G.E.Brown

539.18.08 : 778.34

7732. STATISTICAL FLUCTUATIONS OF BLOB- AND GAP-COUNTS IN NUCLEAR EMULSION. G.Lovera.
Nuovo Cimento (Ser 10), Vol. 3, No. 6, 1476-8 (June, 1956). In Italian.

The value of the standard deviation σ_a of a count of a blobs over a length t of track is given by the expression $\sigma_a^2 = a(1 - ha/a_{max})$ where h is a constant or slowly varying function (according to which theoretical model is used; many references are given). The predicted values of h are compared, they lie in the region 0.70-0.75. It is pointed out that, since a_{max} is an experimentally determinable quantity, the above expression is adequate for practical purposes (with a suitable choice of h), and is independent of the exact mechanism of track formation. R.H.W.Johnston

539.181

7733. ELASTIC SCATTERING OF NITROGEN BY NITROGEN. C.E.Porter
Phys. Rev., Vol. 103, No. 3, 674-5 (Aug. 1, 1956).

The differential cross-section for the elastic scattering of nitrogen by nitrogen is calculated approximately by using a classical model which has been found previously to account for the elastic scattering of alpha-particles by heavy nuclei. The effective mean free path in the collision process is found to be 15 to 35 times smaller than the interaction radius (twice the radius of a single nitrogen nucleus), indicating an extremely strong interaction when two "chunks" of nuclear matter collide. A.

539.185

7734. THE CAPTURE CROSS SECTION OF THERMAL NEUTRONS IN WATER. R.E.Meads, C.J.England, C.H.Collie and G.C Weeks.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 469-79 (June, 1956).

The capture cross-section of slow neutrons by protons has been measured by following the decay of neutrons from a pulsed source in water. The decay was measured by detecting the capture γ-rays with a liquid scintillator. The observed average life in water was 203.3 ± 2.6 μsec corresponding to a capture cross-section of 0.335 ± 0.004 barns at a velocity of 2200 m/sec. A.

539.185

7735. NEUTRON SCATTERING FROM IRON AND CARBON BY TIME-OF-FLIGHT. C.O.Muehlhause, S.D.Bloom, H.E.Wegner and G.N.Glasoe.
Phys. Rev., Vol. 103, No. 3, 720-6 (Aug. 1, 1956).

A fixed-frequency cyclotron in conjunction with millimicrosecond time-of-flight techniques has been used to study elastic and inelastic neutron scattering from iron and carbon in the MeV range. The elastic angular distribution from iron exhibits an optical diffraction type pattern, and the inelastic angular distribution proves to be primarily isotropic except for a slight asymmetry around 90 degress. The elastic angular distribution from carbon is in essential agreement with previous work. A.

539.185

7736. SCATTERING OF FAST NEUTRONS BY NON-SPHERICAL NUCLEI. III. S.I.Drozdov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 786-8 (1956). In Russian.

Results obtained previously for scattering by black non-spherical nuclei Abstr. 8500-1 (1955) are generalized to the case of nuclei with spin. G.E.Brown

539.185

7737. MONOENERGETIC NEUTRON TECHNIQUES IN THE 10- TO 30-MeV RANGE. J.L.Fowler and J.E.Brolley, Jr.
Rev. mod. Phys., Vol. 28, No. 2, 103-34 (April, 1956).

Reviews the techniques for detection of 10 to 30 MeV monoenergetic neutrons with emphasis placed on absolute neutron flux measurements. Charged-particle reactions, which result in monoenergetic neutrons, are discussed; the published cross-section data for the neutron-producing reactions involving the hydrogen isotopes are collected and presented as a function of energy and angle. Sources of background neutrons a are considered. Tables of neutron energies including relativistic effects for the hydrogen isotope reactions are presented. A.

539.185

7738. NEUTRON SPECTROMETRY BASED ON THE MEASUREMENT OF THE DECELERATING TIME OF NEUTRONS. L.E.Lazareva, E.L.Feĭnberg and F.L.Shapiro.
Zh. éksper. teor. Fiz., Vol. 29, No. 3 (9), 381-3 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 351-3 (March, 1956).

It is shown that neutron spectrometry may be carried out by measuring absorption cross-sections at various times after the introduction of neutrons into a slowing-down medium such as lead. An advantage of the method is that no spectrometer or time-of-flight apparatus is required. Also, the neutron current is relatively high. A disadvantage is the limited resolving power (about 30% in energy). J.Thewlis

539.185.08

7739. RECOIL TYPE NEUTRON SPECTROMETER FOR 0.05 TO 1 MeV. G.J.Perlow.
Rev. sci. Instrum., Vol. 27, No. 7, 460-7 (July, 1956).

A neutron energy spectrometer is described. Hydrogen recoils from CH_4 in a proportional counter are collimated and enter a second counter. The sum of the pulse heights is analysed whenever a coincidence occurs. A third counter in anticoincidence discriminates against cases in which all the energy is not lost in the first two. With the collimation used the energy spread is ~ 10% and the efficiency an approximately linear function of energy, being 10^{-5} at 180 keV. A.

539.185.08

7740. PROTON-RECOIL NEUTRON SPECTROMETER. C.H.Johnson and C.C.Trail.
Rev. sci. Instrum., Vol. 27, No. 7, 468-74 (July, 1956).

A proton-recoil telescope with thin polyethylene radiator has been designed for neutron spectroscopy and for neutron detection with known efficiency in the energy region from about 2 to 20 MeV. Five radiator thicknesses may be chosen over this energy region. Protons recoiling near zero degrees from the radiator pass through two proportional counters and terminate in a NaI(Tl) crystal. Triple coincidences gate an analyser for observing the spectrum from the crystal. A spectrum of 13.7 MeV neutrons was observed with a width at half-maximum of 5.3% and 6% background. The efficiency with this resolution at 13.7 MeV is 3.6×10^{-6}. A.

STRUCTURE OF SOLIDS 539.2

539.21 : 536.424.1 : 539.89

7741. HIGH PRESSURE POLYMORPHISM OF IRON. P.W.Bridgman.
J. appl. Phys., Vol. 27, No. 6, 659 (June, 1956).

In a previous paper by Bancroft, Petersen and Minshall on the propagation of shock waves in Fe, it is proposed that at about 13 x 10^4 kg/cm^2 a transition occurs from the α to the γ structure at room temperature. Some experiments on the change of electrical resistance under static loading have been carried out to check this proposal. Resistance decreased smoothly as the pressure was increased up to nearly 18 x 10^4 kg/cm^2, at which point there was a catastrophic failure. The absence of discontinuities in the behaviour suggests that the shock wave result must be explained in a different way. A.J.Kennedy

539.217 : 541.133

7742. CONCERNING A SYSTEMATIC ERROR IN MEASURING DIFFUSION CONSTANTS. D.S.Tannhauser.
J. appl. Phys., Vol. 27, No. 6, 662 (June, 1956).

Discusses the effect of non-uniform initial application of the diffusing molecules in the method of Schamp and Katz (Abstr. 7784/1954). R.O.Davies

539.217

7743. MECHANISM FOR SELF-DIFFUSION IN METALLIC LITHIUM. T.Kojima.
J. Phys. Soc. Japan, Vol. 11, No. 6, 717 (June, 1956).

The activation energy was calculated for various mechanisms. In the case of an interstitial atom the trial wave function for the conduction electrons is of the form $\varphi_K = \psi_K(1 + \beta e^{-\alpha r})$ where ψ_K is the Bloch function, $\alpha\beta$ variational parameters. These are orthogonalized to the wave functions of the interstitial core electrons. Calculated energy is about 1.0 eV for formation of an interstitial atom, less than 0.1 eV for its migration, 0.4 eV for formation of a vacancy and 0.3 eV for its migration (Abstr. 7227/1955). The author suggests that formation and migration of vacancies is the dominant mechanism, which is probable also in other b.c.c. metals. W.Bardsley

539.217

7744. DIFFUSION OF THE CHLORIDE ION IN NaCl. D.Patterson, G.S.Rose and J.A.Morrison.
Phil. Mag. (Ser. 8), Vol. 1, No. 5, 393-9 (May, 1956).

The diffusion of the radioactive Cl^{36} isotope out of solid NaCl particles into a surrounding atmosphere of (initially) non-radioactive chlorine gas has been studied at 358, 435, 467, 495 and 510°C and corresponding values of the Cl^{36} diffusion coefficient, D, have been inferred. These coefficients can be accurately represented by the formula $D = D_0 \exp(-E/kT)$ when E is taken to be 1.67 eV. Previous measurements by Chemla (Abstr. 8492/1952), made at higher temperatures (in the region of intrinsic conductivity), gave E = 2.70 eV. The difference, 1.03 eV, is the same as the difference observed (Abstr. 658/1951) for the Na^+ diffusion coefficient in the intrinsic and "structure-sensitive" regions and represents one half the energy of formation of a pair of Schottky defects. (The results obtained at 467 and 495°C indicated an unexplained change of diffusion coefficient after 10-15 hrs exchange). A.B.Lidiard

539.219

7745. ON THE VALENCE AND ATOMIC SIZE OF SILICON, GERMANIUM, ARSENIC, ANTIMONY, AND BISMUTH IN ALLOYS. L.Pauling and P.Pauling.
Acta cryst., Vol. 9, Pt 2, 127-30 (Feb., 1956).

The metalloids silicon and germanium usually show the valence 4 in alloys, and arsenic, antimony, and bismuth the valence 3, the single-bond radii being equal to the normal covalent radii of the atoms. Analysis of the lattice constants of solid solutions of these elements in lead, copper, and other metals with the Al structure shows that in these solid solutions, on the other hand, the metalloids usually function as metals, with a metallic valence of about 2.5 for silicon and germanium and 1.5 for arsenic, antimony, and bismuth. These lower valences correspond to about 0.75 metallic orbital per atom, the normal amount for metals. A.

539.219

7746. ORDERING OF ATOMS IN THE σ PHASE. J.S.Kasper and R.M.Waterstrat.
Acta cryst., Vol. 9, Pt 3, 289-95 (March, 1956).

A neutron-diffraction study has been made of the ordering of component atoms in the following three σ-phases: Ni–V, Fe–V, Mn–Cr. Definite evidence for ordering is found in all three systems, with different degrees of precision for the three systems. These results, with some X-ray investigations, enable a generalization to be made regarding the scheme of the ordering for binary σ-phases of the first row transition elements (also those containing molybdenum). A.

539.23 : 535.393

PRESENT STATE OF THE THEORY OF THE OPTICAL PROPERTIES OF SEMI-TRANSPARENT METAL COVERINGS. See Abstr. 6545

539.231

7747. A NEW APPARATUS FOR CATHODIC SPUTTERING. L.Holland.
Nature (London), Vol. 177, 1229 (June 30, 1956).

An a.c. glow discharge in oxygen between V shaped electrodes of the metal whose oxide it is desired to sputter is used in conjunction with a vapour source to produce multiple-layer coatings. C.G.Morgan

539.234

7748. THE EFFECT OF INCIDENT ATOMIC VELOCITY ON THE STRUCTURE OF EVAPORATED SILVER FILMS. R.A.Aziz and G.D.Scott.
Canad. J. Phys., Vol. 34, No. 8, 731-6 (Aug., 1956).

The influence of the incident atomic velocity on the structure of evaporated films has been studied for silver films in the thickness range from 50 to 500 A. The thermal velocities of the evaporated atoms were reduced (i) by "reflection" from a Teflon surface at room temperature, and (ii) by "diffusion" through nitrogen gas at 3.0 μ. Films formed by these two methods are compared with "normal" high vacuum films for the same rates of deposition, which were relatively slow (0.4 to 4 A of thickness per second). The results of both resistivity measurements and electron microscopy show that "diffusion" films are less aggregated, i.e. more continuous, than "normal" high vacuum films. "Reflected" films have a structure intermediate between the other two. A qualitative explanation of the observed effects is given in terms of the formation of nuclei and the growth of aggregates. A.

539.234 : 535.345

7749. THE TEMPERATURE DEPENDENCE OF THE OPTICAL ABSORPTION OF ZINC SELENIDE. H.Tubota, H.Suzuki and O.Matumura.
J. Phys. Soc. Japan, Vol. 11, No. 5, 610 (May, 1956).

The absorption of evaporated films, 1 μ in thickness was measured, at temperatures from 295 to 496° K. Assuming a formulae for the energy gap $E = E_0 + \alpha T$, values of 2.9 eV and −0.001 eV/°K were found for E_0 and α. D.G.Avery

539.234 : 535.39

THE INFLUENCE OF DISPERSION ON THE OPTICAL DETERMINATION OF THE THICKNESS OF THIN FILMS. See Abstr. 6544

539.26

7750. LOW-ANGLE X-RAY SCATTERING BY SURFACE DEFECTS. W.H.Robinson and R.Smoluchowski.
J. appl. Phys., Vol. 27, No. 6, 657-8 (June, 1956).

The intensity of low-angle scattering from cold-rolled and annealed zinc foil was reduced by electropolishing; this shows that the scattering arises from surface defects.

A.R.Stokes

539.27

7751. SOME PECULARITIES OF THE ELECTRONOGRAPHIC (ELECTRON-DIFFRACTION) INVESTIGATION OF HIGH POLYMERS. A.L.Zaïdes and I.G.Stoyanova.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 711-14 (1956). In Russian.

Since the intensity of the scatter of electrons by a crystal varies as the square of the number of molecules in the lattice, whereas that of the scatter caused by molecules of non-crystalline substances varies as the first power of the same number, it is better to use thicker films for electron diffraction (particularly in the case of polymers). To avoid undue increase in the total number of scattered electrons it is advantageous to use an accelerating potential. It was found experimentally that, e.g., for quartz films 1.6 $\mu g/cm^2$ thick, the increase of the accelerating potential from 45 to 80 kV reduced the magnitude of the diffuse background by 66-75%. This reduction was associated with a change in the relationship between the interference maxima and the background. To obtain an electron diffraction record of a high polymer, which would reveal its real structure, it is necessary to combine the optimum values of the accelerating potential, beam width, intensity of irradiation and film thickness. It is always advisable to check the results of electron diffraction examination by X-ray diffraction photography.

F.Lachman

539.27

7752. ON THE ELECTRON DIFFRACTION PATTERNS FROM THE ORIENTED SILVER FILMS. Y.Watanabe.
J. Phys. Soc. Japan, Vol. 11, No. 7, 740-7 (July, 1956).

Rotation patterns of electron diffraction from oriented silver films prepared by condensation in vacuo on to heated NaCl crystal surface, were obtained by rotating the films about the (100) axis lying in the films. The intensity distribution along the hyperbolae appearing in the patterns was measured. The observed intensity was in good agreement with the intensity calculated on the assumption that the silver film is composed of parts of the parallel-growth structures, the twin structures, and the structures having defects proposed by Göttsche (Abstr. 7200/1953). It was found by electron microscopy that twin structures occur here and there on a submicroscopic scale, but displacement of diffraction spots due to twin faults was not detected.

A.

ELASTICITY. STRENGTH. RHEOLOGY 539.3/.8

539.31 : 537.226.3

7753. ANELASTICITY AND DIELECTRIC LOSS OF QUARTZ. R.K.Cook and J.H.Wasilik.
J. appl. Phys., Vol. 27, No. 7, 836-7 (July, 1956).

Provides additional evidence that certain anelastic effects in quartz reported by Cook and Breckenridge (Abstr. 3927/1954) and dielectric losses reported by Stuart (Abstr. 312/1956) are caused by the same physical mechanism, i.e. the motion of metallic interstitial ions in the "tunnels" of the quartz lattice which run parallel to the optic axis.

W.Bardsley

539.313

7754. EFFECT OF SHAPE ON THE STATIC AND DYNAMIC STRESS–STRAIN RELATIONSHIP OF BONDED RUBBER IN COMPRESSION. A.R.Payne.
Nature (London), Vol. 177, 1174-5 (June 23, 1956).

An experimental study has been made of the relationship between mean compressive stress and compression ratio λ in specimens of various sizes with both ends bonded to metal. For circular cylinders of a pure gum natural rubber vulcanizate in static tests, the load required for a given λ is increased by a factor $1 + 0.413\,\delta^2$, compared with the case of perfectly lubricated ends, where δ is the radius/height ratio ($\delta \leq 8$, $\frac{1}{2} \leq \lambda \leq 1$).

J.G.Oldroyd

539.313

7755. FINITE PLANE DEFORMATION OF THIN ELASTIC SHEETS REINFORCED WITH INEXTENSIBLE CORDS. J.E.Adkins.
Phil. Trans. A, Vol. 249, No. 961, 125-50 (1956).

A general theory is formulated, in tensor notation, for the finite elastic deformation of curvilinearly aeolotropic materials which are subject to constraints, the aeolotropy and the system of constraints being related to different curvilinear frames of reference in the undeformed body. The results obtained are utilized in considering the general two-dimensional deformation of a thin, plane, uniform sheet of elastic material, reinforced by means of a continuous layer of thin, flexible, inextensible cords lying in the plane midway between its major surfaces. These cords coincide with either or both of the families of curves which constitute a general curvilinear coordinate system in the plane in which they lie. The theory is formulated initially for materials which exhibit a type of aeolotropy which is general, except for the restriction required for the structure of the plate to be symmetrical about the reinforcing layer. When there are two sets of cords, the governing differential equations are hyperbolic, with the characteristic curves coinciding with the paths followed by the cords, and the solution of these equations, subject to various types of boundary condition, is investigated. When the cords lie initially in two sets of parallel straight lines, the stress resultants and displacements can be expressed in terms of real arbitrary functions. This type of solution is employed to examine the deformation of an infinite plane sector, with a system of stresses and displacements prescribed along its edges. The general theory for a sheet reinforced with a single set of cords is also developed briefly. The linear equations for classically small deformations are derived both for this case, and for a sheet containing two sets of cords, and when the cords lie initially in parallel straight lines these equations are solved in terms of arbitrary functions.

A.

539.32

7756. THE ELASTICITY OF SINGLE CRYSTALS OF LEAD. S.C.Prasad and W.A.Wooster.
Acta. cryst., Vol. 9, Pt 1, 38-42 (Jan., 1956).

Lead single crystals of some 2 cm diameter were grown by slow cooling from the melt. Faces parallel to (100) and (110) were cut with a microtome, and polished electrolytically. The crystals obtained were perfect, at least as far as was tested by the present measurements. Spectrometer studies on the diffuse scattering at points on the lines parallel to [110], [$\bar{1}$10] and [001] passing through the reciprocal-lattice point 220 lead to the elastic ratios $c_{12}/c_{11} = 0.78 \pm 0.05$ and $c_{44}/c_{11} = 0.28 \pm 0.02$. The photographic study was made on a photograph of the diffuse spot associated with the reciprocal-lattice point 400. The elastic ratios obtained were substantially the same as those given above. The known compressibility was used to obtain the absolute values as follows: $c_{11} = 5.0(3)$, $c_{12} = 3.9(3)$, $c_{44} = 1.4(0) \times 10^{11}$ dyne cm^{-2}; $s_{11} = 63.(2)$, $s_{12} = -27.(7)$, $s_{44} = 71.(4) \times 10^{-13}$ cm^2 $dyne^{-1}$. The main discrepancy between these values and those obtained by other methods is in the value of $(c_{11}-c_{12})$. The present method measures this directly and is believed to be more accurate than the previous measurements. The differences in the s_{ik}'s are a consequence of this discrepancy in $(c_{11}-c_{12})$.

A.

539.32

7757. THE ELASTICITY OF IRON PYRITES, FeS_2.
S.C.Prasad and W.A.Wooster.
Acta cryst., Vol. 9, Pt 2, 169-73 (Feb., 1956).

The elastic constants of iron pyrites, FeS_2, have been determined by a photographic method. The diffuse reflection associated with the reciprocal-lattice point 440 was studied, using Mo Kα radiation and a zirconium screen in front of the photographic film. Two photographs were obtained with the [001] axis inclined to the vertical at 0° and 45° respectively. A microdensitometer survey of the diffuse spots enabled the elastic ratios c_{12}/c_{11} and c_{44}/c_{11} to be determined. These were combined with the known value of the cubic compressibility to give the values $c_{11} = 37.(7)$, $c_{12} = 3.(2)$, $c_{44} = 10.(9) \times 10^{11}$ dyne cm^{-2}; $s_{11} = 2.6(9)$, $s_{12} = -0.002$, $s_{44} = 9.(2) \times 10^{-13}$ cm^2 dyne^{-1}. Contrary to the findings of previous investigators, c_{12} is positive and s_{12} is negative. Thus the only previously accepted exception to the rule that s_{12} is of opposite sign to s_{11} appears not to be an exception. A.

539.32

7758. THERMOELASTICITY OF SILICONE DIELECTRICS.
K.A.Andrianov and N.N.Sokolov.
Elektrichestvo, 1956, No. 6, 31-4. In Russian.

Whilst the thermal stability of silicone polymers as contrasted with organic polymers is generally recognised and was investigated in great detail, not much attention has been devoted to the equally important characteristic of thermoelasticity, i.e. conservation of the elastic properties of the materials at high temperatures, nor to the mechanism or structural causes of these properties. The authors' investigations revealed that the high resistance of silicones to thermal destruction are due to the high Si-O bond energy, the increased resistance to oxidation of the organic Si radicals owing to the protective effect of the siloxane bond for these radicals, furthermore to the formation of stable siloxane bonds in the polymer instead of oxidized radicals, this preventing the decomposition of the macromolecules. During the thermal oxidation process a protective layer saturated with siloxane bonds forms on the surface of the polymer. Polyorganic silicones containing methyl, vinyl and phenyl radicals possess highest thermoelasticity. With an appropriate choice of the constituents of the polymer, its thermoelasticity is directly proportional to its thermal stability, considering its degree of polarity and corresponding adhesion. B.F.Kraus

539.32 : 534.321.9

7759. APPARATUS FOR THE MEASUREMENT OF PHYSICAL CONSTANTS BY THE ELASTIC VIBRATIONS METHOD. A.V.J.Martin.
J. Brit. Instn Radio Engrs, Vol. 16, No. 3, 167-83 (March, 1956).

Constitutes an elementary introduction to the technique of measurement of elastic properties of matter by ultrasonics and is divided into three parts. The first part reviews briefly the classical theories of elasticity. In the second part, the more common methods of measurement are surveyed, with particular reference to the pulse method. Finally, a versatile equipment is described which has been used with satisfactory results for testing samples of gases, liquids and solids of several sizes ranging approximately from 1 to 5 cm in length. The equipment is designed to cover a frequency range 0.5 to 50 Mc/s, a temperature range of from 0° to 100°C and pressures up to 10 000 kg/cm^2. A.

539.32.08

7760. TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF MONOCRYSTALS OF SODIUM CHLORIDE AND SILVER CHLORIDE. A.V.Stepanov and I.M.Éĭdus.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 669-75 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 377-82 (May, 1956).

Results are reported of the measurements in the range from room temperature to the melting point. A.

539.374

7761. INFLUENCE OF THE SUBSTRUCTURE OF SINGLE CRYSTALS OF ALUMINIUM ON THE SHAPE OF THE CURVES OF PLASTIC DEFORMATION. B.Jaoul.
C.R. Acad. Sci. (Paris), Vol. 242, No. 19, 2372-4 (May 7, 1956). In French.

By annealing after plastic deformation the single crystals behave differently according to their initial orientation, resulting either in a real recrystallization, a complete recovery or polygonization. These conditions are characterized by new deformation curves of altogether different shape and are interpreted in terms of the size of the substructure of the crystal. W.Bardsley

539.374 : 539.89

7762. PERMANENT DEFORMATIONS IN SOLIDS AFTER THE APPLICATION OF HIGH HYDROSTATIC PRESSURES. P.Johannin and Haï Vu.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2579-81 (May 23, 1956). In French.

Extends earlier work (Abstr. 731/1956) on polycrystalline Zn, Cd and Al to the more complex case of an alloy, in particular brass. Pure Cu was found to show no deformation. The brasses with 5% and 35% Zn showed little deformation whilst those with 15% and 24% Zn showed marked deformation after being subject to a pressure of 3000 atmospheres. A brass single crystal showed deformation. This is interpreted in terms of the possible irregular distribution of Zn in the alloys W.Bardsley

539.374

7763. ON VISCOELASTIC BODIES BEHAVING LINEARLY. J.Mandel.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2803-5 (June 11, 1956). In French.

An application of the method reported in Abstr. 2480 (1956) is made to the theory of propagation of stress discontinuities and sinusoidal elastic waves. J.G.Oldroyd

539.374

7764. PLASTIC DEFORMATION AT A LOW TEMPERATURE OF SINGLE CRYSTALS OF REFINED ALUMINIUM. B.Jaoul.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3039-42 (June 25, 1956). In French.

The deformation curves of single crystals at −195°C are found to be but little influenced by the orientation of the specimens, in contrast to the behaviour at room temperature. Furthermore the geometry of the deformation is of the same form for all the experiments in tension at −195°C. The deformation is more confused than at room temperature, the slip lines being fine and numerous, but also short and sinuous and more than one system is seen to be operating. Study of the variation in the rate of hardening shows that the mechanism proposed by Friedel (Abstr. 3324/1956) starts to develop actually at the elastic limit. W.Bardsley

539.374

7765. VARIATIONS IN THE SLOPE OF THE CURVES OF PLASTIC DEFORMATION OF METALS. B.Jaoul.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 16-19 (July 2, 1956). In French.

After a "pseudo-elastic" (reversible slip) and an "elastic plastic" (only some slip reversible) region, the slope of the deformation curves reaches a value equal to E/100 where E is the modulus of elasticity. After this point deformation is completely plastic and the rate remains constant if the temperature is sufficiently low; otherwise the hardening increases less rapidly and the curve departs from theory. This rate of hardening already observed in single crystals can perhaps be considered as a modulus of plasticity. Deformation curves for polycrystalline Al–Mg alloys, Al, Zn, Fe, Cu, Fe–Ni and stainless steel are given. W.Bardsley

539.374 : 534.22/.23

SENSITIVITY OF ULTRASONIC ATTENUATION AND VELOCITY CHANGES TO PLASTIC DEFORMATION AND RECOVERY IN ALUMINIUM. See Abstr. 6442

539.389.3

7766. A STUDY OF THE KINETICS OF AGEING AFTER COLD DEFORMATION BY MEASUREMENT OF THE ELECTRICAL RESISTANCE AT −193°C. I. EXPERIMENTAL PART. A.Mašín and V.Havel.
Czech. J. Phys., Vol. 6, No. 3, 269-86 (June, 1956). In German.

The mechanism of ageing after cold deformation of two kinds of steel has been studied over a period of 100 days by measurement of the electrical resistance. The results are interpreted in terms of a precipitation process characterized by three stages. In the first stage a submicroscopic precipitate is formed: in the second stage this primary precipitate dissolves and a stable, secondary precipitate forms: and in the third state there is a coalescence of these secondary precipitates. On samples deformed suddenly the solution of the broken-up carbides was observed. A.E.De Barr

539.42

7767. TIME DEPENDENCE OF MECHANICAL BREAKDOWN PHENOMENA. B.D.Coleman.
J. appl. Phys., Vol. 27, No. 8, 862-6 (Aug., 1956).

A phenomenological theory of the time dependence of mechanical breakdown phenomena is presented which is applicable to creep failure of oriented polymeric filaments under tensile stresses. In using the theory, one makes assumptions about the distribution of breaking times in ensembles of filaments which are bearing constant loads and then proceeds to calculate the distribution of lifetimes under other stress histories, e.g. loads increasing linearly with time and sinusoidal loads. The assumptions used here permit a calculation of the dependence of observed tensile strengths on both the sample size and the rate of loading. Experiments involving drawn 66-nylon monofilament yarn are cited to illustrate how the parameters which describe the average lifetime under dead load behaviour of a yarn may be used to calculate its tensile strength distribution when measured with a constant rate of loading apparatus. A.

539.42 : 548.7

7768. EFFECT OF GROWTH IMPERFECTIONS ON THE STRENGTH OF ALUMINUM SINGLE CRYSTALS. M.Lauriente and R.B.Pond.
J. appl. Phys., Vol. 27, No. 8, 950-4 (Aug., 1956).

The effect of growth imperfections on the critical resolved shear stress is investigated for high-purity (99.99 + %) aluminium single crystals as compared with strain-anneal crystals. An apparatus for measuring strains of the order of 0.2 μin. is described. Using etch pits as an index, the critical resolved shear stress is found to be inversely proportional to the growth imperfections for a range of etch pit density of 5 to 25 x $10^4/cm^2$. An elastic range is demonstrated; and prior plastic deformation is found to lower Young's modulus. The results are interpreted in terms of dislocation theory. A.

539.576 : 532.528

7769. EROSION OF METAL SURFACES BY ULTRASONIC CAVITATION. R.Esche and H.Kimmel.
Z. Naturforsch., Vol. 11a, No. 6, 515 (June, 1956). In German.

A summary is given of experiments on the cavitation of Al and Cu surfaces using excitation frequencies in the range 20-1200 kc/s. Microscopic examination of lightly etched surfaces showed that cavitational attack was similar to that by etchants, indicating that the degree of attack by cavitation is influenced by the crystallographic orientation of the grains. H.J.H.Starks

539.58

7770. DEVICE FOR APPLYING COMPRESSION TO SMALL CRYSTALS. E.J.Rapperport.
Rev. sci. Instrum., Vol. 27, No. 7, 446-7 (July, 1956).

The design of an apparatus for applying uniaxial compression to specimens with cross-sections up to $\frac{1}{4}$ inch square is described. One feature of the apparatus is the construction of the force transmitting linkage. This linkage was designed to minimize the transmission of shear forces and thus to avoid bending moments on the samples. The apparatus enables the compressive forces acting on the samples to be determined to within 0.1%. A.

539.61

7771. THE FRETTING CORROSION OF MILD STEEL. J.S.Halliday and W.Hirst.
Proc. Roy. Soc. A, Vol. 236, No. 1206, 411-25 (Aug. 2, 1956).

A quantitative investigation is described. Measurements have been made of the frictional forces, the degree of damage and the variations in the electrical contact resistance for a wide range of applied loads, vibration amplitudes and number of cycles of motion. In addition, the nature of the fretting corrosion scars and debris has been examined using optical and electron microscopy and electron diffraction. The same sequence of phenomena is observed under all conditions, namely, (i) the formation of intermetallic welds, (ii) the production of black α-Fe_2O_3 particles and ultimately (iii) the production of fine red-brown α-Fe_2O_3 particles. However, the magnitude of the frictional forces, the wear rates and the contact resistances are greatly dependent upon the amplitude of vibration. At large amplitudes large intermetallic junctions form soon after the onset of motion and the friction rapidly rises above its initial value. Subsequently the friction drops to a very low value, $\mu \sim 0.05$; this is due to the presence of loose oxidized debris which accumulates and tends to roll between the rubbing contacts. At small amplitudes the scale of the welding is so reduced that no perceptible rise in friction occurs before the friction falls to its final low value. Measurements of the depths of damage in the scars show that the holes which form arise from the original welding mechanism and that they subsequently disappear. At large amplitudes the wear rates obey the same simple rules of wear as are obeyed in unidirectional motion, namely, the wear is proportional to the distance of sliding; the wear rate is proportional to the load and independent of the apparent area of contact. Furthermore, there is close agreement in the magnitude of the wear rates in unidirectional motion and during fretting at large amplitudes. At small amplitudes, however, much smaller rates of damage are obtained. A.

539.62

7772. THE STAGES IN A PROCESS OF SEVERE METALLIC WEAR. M.Kerridge and J.K.Lancaster.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 250-64 (Aug. 2, 1956).

In order to provide information about the basic processes involved in the wear of metals, a detailed study has been made of a severe type of wear. The particular system chosen was the wear of brass against a harder material under conditions in which the debris produced is metallic. Using radioactivity methods, transfer of metal between the rubbing surfaces was determined concurrently with measurements of the total wear. In experiments at various loads, the relationship between the rates of transfer and wear was studied. Particle-size distributions of the wear debris were obtained and compared with size distributions of the transferred fragments. It is concluded that wear occurs via a layer of transferred metal and that there is no direct production of loose wear particles. The wear process has at least two distinct stages; namely, the removal of metal from the wearing surface by transfer and the formation of wear debris from the transferred layer on the opposing member. The magnitude of the applied load determines primarily the scale of the phenomena rather than the rate at which they occur. A.

539.62

7773. THE WEAR OF METALS UNDER UNLUBRICATED CONDITIONS. J.F.Archard and W.Hirst.
Proc. Roy. Soc. A, Vol. 236, No. 1206, 397-410 (Aug. 2, 1956).

The wear of a wide range of material combinations has been studied in unlubricated conditions. Loads of 50 g to 10 kg and speeds of 2 to 660 cm/sec have been used. A representative selection of the results is given. As a broad classification two contrasting mechanisms of wear have been observed. In nearly all experiments, and for all types of wear mechanism, once equilibrium surface conditions are established the wear rate is independent of the apparent area of contact. The wear rate is accurately proportional to the load for only a limited number of combinations but there are many other examples for which the relation between wear rate and load shows only a small deviation from direct proportionality. It is suggested that with the same surface conditions the wear rate is proportional to the load; in practice this simple relation is modified because the surface conditions depend on the load. These rules of wear may be derived, on a priori grounds, from the experimental results, or from more detailed theoretical calculations. A.

539.67

7774. THE INTERNAL FRICTION OF METALS. G.Lüschner.
Technik, Vol. 11, No. 4, 289-300 (April, 1956). In German.

The internal friction is represented as a result of the relation between elongation and stress. It is shown that stress and elongation depend to some extent on time (anelasticity). Another factor in this connection is dynamic hysteresis, which is a special case of relaxation, a general property of linear systems. Relaxation is the property tending to re-establish the equilibrium of a system after an interval of time. This means in the present case that deformation is determined not only by the instantaneous external forces but also by the variation of the forces. These effects can be approximated by an exponential function. Static hysteresis appears in the material which do not have any noticeable relaxation properties and is independent of the frequency. The causes of internal friction are internal structural rearrangements, including thermoelastic effects, and the transmission of vibration from grain to grain in the case of polycrystalline metals. Other causes are an interaction between the conductivity electrons and the elastic lattice vibrations. This has not been determined experimentally, but was calculated for certain cases. In ferromagnetic materials there are magneto-elastic effects producing magneto-strictive non-elastic elongation, which causes mechanical vibrations to be damped. The stress-induced ordering of atoms in the metal lattice is different from the equilibrium distribution and the tendency of the metal to re-establish the equilibrium condition by means of irreversible processes causes internal friction. The grain-boundary viscosity has anelastic effects, also dislocation and plastic flow due to cold working and phase transformation in conjunction with a dimensional change. The following methods are employed to measure internal friction: the phase angle is measured to determine the damping effect, the hysteresis loop is recorded directly; the area of the loop is a measure of internal friction. The loop is recorded for up to 50 c/s by mechanical methods, and for higher frequencies by means of the cathode-ray oscillograph. This method can be employed only if the internal friction is very high. In other cases, internal friction is measured by comparing forced vibrations and decaying vibrations. The following methods are employed for converting electrical vibrations and mechanical ones, and vice versa: electrostatic, eddy current, electro-magnetic, piezo-electric, etc. 183 ref J.Smuts

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.115

7775. PYROLYSIS OF DIMETHYL ETHER. S.W.Benson.
J. chem. Phys., Vol. 25, No. 1, 27-31 (July, 1956).

An analysis of the published data on the pyrolysis of dimethyl ether shows that the reaction can be interpreted as a chain decomposition initiated by $CH_3OCH_3 \rightarrow CH_3 + OCH_3$ (reaction 1), terminated by CH_3 radical recombination and accelerated by the chain transfer reaction $CH_3 + H_2 \rightarrow CH_4 + H$. A simplified Rice–Herzfeld mechanism then gives for the overall rate of reaction the expression

$$\frac{-d(Me_2O)}{dt} = k_0(Me_2O)^{3/2}\left[1 + \beta\frac{(CH_2O)}{(Me_2O)} + \frac{\alpha(H_2)}{(Me_2O)}\right]$$

where $k_0 = k_2(k_1/k_{10})^{1/2}$; k_2 representing H abstraction by CH_3 from Me_2O and k_{10}, CH_3 recombination. The data yield a value of $k_0 = 4.31 \times 10^{-3}$ (litre mole)$^{1/2}$ sec^{-1} at 777°K. Using published data on k_2 and k_{10}, an estimated activation energy $E_1 = 81.1$ kcal and an estimated value of $\Delta S_1^\circ = 38$ cal mole^{-1}°K one finds $A_1 = 6.1 \times 10^{16}$ sec^{-1} and for the reverse reaction to 1, $A_{-1} = 7.0 \times 10^{9}$ litre mole sec. The data do not permit evaluation of β while α is in the range 0.3 to 0.4 for both H_2 and D_2. Independent calculations of α yield the values 0.8 for H_2 and 0.6 for D_2, both calculations have a probable error of a factor of 2. For the over-all activation energy of the $\frac{3}{2}$ order chain, $E_0 = 50.0$ kcal. It is proposed that the observed exchange of Me_2O with D_2 is a heterogeneous reaction. A.

541.123.5

7776. MODEL FOR ION-EXCHANGE RESINS. F.E.Harris and S.A.Rice.
J. chem. Phys., Vol. 24, No. 6, 1258 (June, 1956).

A polyelectrolyte gel model is considered. Influence of crosslinking, exchange capacity and the identity of the ions in the resin, on swelling and ion-exchange are evaluated. Quantitative agreement is claimed for several cation exchangers. G.Aller

541.124

7777. CALCULATION OF PARAMETERS OF RECTIFYING COLUMNS. V.P.Peshkov.
Zh. tekh. Fiz., Vol. 26, No. 3, 664-9 (1956). In Russian.

Equations are derived for calculating the efficiency of rectifying columns in which there are laminar and turbulent flows for any values of the distribution coefficient. The hold-up and the time required for the attainment of a steady state in the column can also be worked out. The calculations are illustrated by reference to the rectification of helium. R.C.Murray

541.126

7778. MECHANISM OF THE DECOMPOSITION OF PRIMARY AND SECONDARY n-BUTYL FREE RADICALS. J.R.McNesby, C.M.Drew and A.S.Gordon.
J. chem. Phys., Vol. 24, No. 6, 1260 (June, 1956).

The mechanism for the production of the major products ethylene and propylene, is investigated by the photolysis and pyrolysis of acetone in the presence of n-butane- 2, 2, 3, 3, -d_8.

at the total pressure of 32 mm. A vapour phase chromatograph is used to identify the products. The results show that the intramolecular transfer of H atoms from one carbon atom to another in the n-butyl radical is unlikely, and the probable mechanisms are:

$$CH_2CD_2CD_2CH_3 \rightarrow CH_3CD_2 + CH_2 = CD_2$$
$$CH_3CD\,CD_2CH_3 \rightarrow CH_3CD\,=CD_2 + CH_3$$

G.Allen

541.126

7779. INTERPRETATION OF THE KINETICS OF MERCURY ALKYL PYROLYSIS. H.O.Pritchard.
J. chem. Phys., Vol. 25, No. 2, 267-70 (Aug., 1956).

The high-frequency factors observed for the thermal decomposition of some mercury dialkyls are shown to be consistent with the hypothesis that the primary step is a fission into three fragments rather than two; this mechanism is possible because of an almost unique thermochemical property of the mercury alkyl system and, within the limitations of the simple approximation used, is not incompatible with the concept of localization of activation energy within the critical bonds. A.

541.126 : 536.46

7780. STEADY-STATE BURNING OF A LIQUID DROPLET. II. BIPROPELLANT FLAME. J.Lorell, H.Wise and R.E.Carr.
J. chem. Phys., Vol. 25, No. 2, 325-31 (Aug., 1956).

For Pt I see Abstr. 752 (1956). The flame equations for the steady-state combustion of a liquid droplet are adapted to the case of a bipropellant system. The material transfer of two reactants, fuel and oxidizer, which interdiffuse from opposite directions is considered. As a result, a diffusion flame is established at some distance from the liquid surface. The theoretical analysis is applied to the combustion of an ethanol droplet in oxygen and air, and the effects of various chemical and physical parameters on the burning process are examined. A.

541.127 : 535.379

7781. ROLE OF NITRIC OXIDE IN THE THERMAL DECOMPOSITION OF NITROUS OXIDE. F.Kaufman, N.J.Gerri and R.E.Bowman.
J. chem. Phys., Vol. 25, No. 1, 106-15 (July, 1956).

The rates of decomposition of N_2O and of formation of NO were measured simultaneously in a static system. NO yields at the beginning of reaction are as high as 50 to 60%, but NO quickly inhibits its own further formation. From initial NO yields, information about the reaction of oxygen atoms with N_2O and about wall recombination was obtained. Limiting NO pressures for complete N_2O decomposition were interpreted in terms of the reaction $NO + O + M \rightarrow NO_2 + M$, and its rate constant was calculated. The effect of increased surface area and of added gases was studied. The halogens were found to be efficient inhibitors of NO formation. The chemiluminescence of reacting N_2O was observed and its dependence on temperature, pressure, and added gases studied. All evidence points to the reaction $O + NO \rightarrow NO_2 + h\nu$ as its origin. Inhibition of NO formation and of chemiluminescence are shown to be closely related. A.

541.127.1

7782. NEW FORMULATION OF GASEOUS UNIMOLECULAR DISSOCIATION RATES. N.B.Slater.
J. chem. Phys., Vol. 24, No. 6, 1256-7 (June, 1956).

This arises if the activated states are so closely specified that the lifetime to dissociation is determinate. The extreme cases of (i) random and (ii) regular occurrences of molecular dissociations are considered. G.Allen

541.128

7783. ELEMENTARY STEPS IN CATALYTIC EXCHANGE REACTIONS. J.Adam, R.Coekelbergs, A.Frennet and P.A.Gosselain.
J. chem. Phys., Vol. 24, No. 6, 1267-8 (June, 1956).

HCl or CH_3Cl vapours are introduced into a reaction vessel containing HCl^{36} adsorbed on a tungsten coating, and the exchange is followed by the rate of appearance of HCl^{36} or CH_3Cl^{36} in the gas phase. The results do not support the Hinshelwood–Langmuir mechanism, and a mechanism involving irreversibly formed W–Cl active centres is proposed. G.Allen

ELECTROCHEMISTRY 541.13

541.13 : 539.537

ON THE ELECTROCAPILLARY EFFECT OF THE LOWERING OF HARDNESS AND THE EXTERNAL FRICTION OF METALS. See Abstr. 6987

541.132

7784. RATE OF ELECTRON EXCHANGE BETWEEN CUPROUS AND CUPRIC IONS IN HYDROCHLORIC ACID SOLUTIONS BY NUCLEAR MAGNETIC RESONANCE. H.M.McConnell and H.E.Weaver, Jr.
J. chem. Phys., Vol. 25, No. 2, 307-11 (Aug., 1956).

A determination of the Cu^{63} nuclear resonance line-width in concentrated hydrochloric acid solutions containing both cuprous and cupric chloride leads to an evaluation of the bimolecular rate constant k for the electron exchange process $Cu^{++} + Cu^{+} \rightarrow Cu^{+} + Cu^{++}$. The experimentally determined value for k is $k = 0.5 \times 10^8$ litre/mole-second. A.

541.133 : 532.13/.14

SIMULTANEOUS MEASUREMENTS OF DENSITY, VISCOSITY, AND ELECTRIC CONDUCTIVITY OF MELTS. See Abstr. 6406

541.133.1

7785. TEST OF THE APPLICABILITY OF THE NERNST–EINSTEIN EQUATION TO SELF-DIFFUSION AND CONDUCTION OF IONS IN MOLTEN SODIUM CHLORIDE. A.Z.Borucka, J.O'M.Bockris and J.A.Kitchener.
J. chem. Phys., Vol. 24, No. 6, 1282 (June, 1956).

Na^{22} and Cl^{36} are used as radio-tracers to determine the self-diffusion coefficients of Na and Cl in molten NaCl by the capillary method. Results show that the Nernst–Einstein equation cannot be used to predict ionic mobilities from diffusion coefficients for molten salts. The probable explanation is that the measured diffusion includes the movement of entities such as Na^+Cl^- pairs which do not contribute to conduction. The diffusion coefficients are compared with estimates based on the Stokes–Einstein equation. G.Allen

541.135 : 539.321.9

7786. INFLUENCE OF DIFFERENT GASES ON THE ELECTROCHEMICAL EFFECTS ACCOMPANYING ULTRASONIC ACTION. R.Audubert, J.Guitton and R.O.Prudhomme.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3079-81 (June 25, 1956). In French.

The influence of air, CO_2, H_2, and ether, on the effects produced by ultrasonic action on the electrochemical phenomena at a Cu anode or cathode immersed in various electrolytes ($CuSO_4$ in $2N.H_2SO_4$ and $Cu_3(PO_4)_2$ in $3N.H_3PO_4$), are described with respect to the appearance of the electrode and to oxidation phenomena. It is shown that CO_2, by suppressing cavitation, inhibits the formation of striae on the electrodes without suppressing the lowering of overvoltage. H.H.Hodgson

541.135.4

7787. EXPERIMENTAL STUDY OF THE DIFFUSION OF IONS THROUGH ELECTROLYTIC DEPOSITS UNDER THE INFLUENCE OF AN ELECTRIC FIELD. J.Royon.

C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3077-8 (June 25, 1956). In French.

Previous data (Abstr. 1215/1953) for the diffusion of Cu ions through electrolytic deposits of Ni, are now supplemented by the results obtained when an electric field is imposed. Labelled Cu^{64} is used as metallic support for the Ni deposits of various thicknesses, and the variations are followed of the radioactivity of a solution of $CuSO_4$ (in which the Ni-Cu^{64} electrode is immersed) as a function of the time and of the imposed field. When the Cu electrode is positively polarized, the time of passage decreases with increase of polarization, but, when negatively polarized, the time is too great for measurement. Curves are of the general form of those afforded by electronic lamps. H.H.Hodgson

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.14

7788. METASTABLE STATES OF PHOTO-EXCITED OVALBUMIN AND CONSTITUENTS. L.I.Grossweiner.
J. chem. Phys., Vol. 24, No. 6, 1255-6 (June, 1956).

Using a flash photolysis technique absorption spectra of metastable states in ovalbumin and constituents have been determined. It is concluded that the transient spectrum of ovalbumin is mainly a sum of contributions from tyrosine and tryptophan with negligible effects from the peptide linkage. Some of the absorption bands suggest the excitation of indole and phenol groups. W.Good

541.14

7789. MERCURY PHOTOSENSITIZED REACTION OF CYCLO-OCTATETRAENE. H.Yamazaki and S.Shida.
J. chem. Phys., Vol. 24, No. 6, 1278-9 (June, 1956).

The dependence of the rate of decomposition on the initial pressure of the cyclo-octatetraene in a mercury photosensitized and in a direct photochemical reaction (by the mercury resonance line, 2537 A) are determined and the quantum yield variation with pressure evaluated. It is concluded that the two reactions proceed via the same excited (probably triplet) state. W.Good

541.144

7790. PHOTOCHEMICAL OXYGEN–HYDROGEN REACTION AT 1849 A. D.H.Volman.
J. chem. Phys., Vol. 25, No. 2, 288-93 (Aug., 1956).

The reaction was studied at atmospheric pressure in a flowing system using the 1849.6 A mercury resonance line as a light source. The yields of hydrogen peroxide, water and ozone were determined. The results obtained above the convergence limit of the oxygen molecule absorption spectrum are in agreement with those obtained in other studies below the convergence limit. The predissociation of oxygen molecules to form oxygen atoms as the primary process following light absorption is shown to be the only reaction of optically excited oxygen. The mechanisms used to explain the formation of products, ozone, hydrogen peroxide and water, are compatible with well-known reactions in various oxygen–hydrogen systems. A.

541.15

7791. RADIATION CHEMISTRY OF n-HEXANE AND CYCLOHEXANE LIQUIDS. H.A.Dewhurst.
J. chem. Phys., Vol. 24, No. 6, 1254-5 (June, 1956).

n-Hexane liquid irradiated with electrons (dose, 8.7×10^{21} eV/g) gave a chromatogram (gas-liquid partition chromatography) with 16 peaks and therefore at least 16 products were formed. n-Pentane 3-methylpentane, n- and isomeric dodecanes, hexenes (by mass spectrometric analysis) are identified. The chromatogram of irradiated cyclohexane liquid (dose, 5.8×10^{21} eV/g) showed only three peaks identified as those of cyclohexene, dicyclohexyl and n-hexane. The diversity of products arising from the irradiation of n-hexane suggests random rupture of C–H and C–C bonds, while the simplicity of product formation in the radiolysis of cyclohexane must be attributed to preferential rupture of C–H bonds, the ring system remaining essentially intact. W.Good

DISPERSIONS. COLLOIDS. ADSORPTION 541.18

541.182

7792. THE INTERACTION OF TWO IDENTICAL SPHERICA COLLOIDAL PARTICLES. I. POTENTIAL DISTRIBUTION. N.E.Hoskin.
Phil. Trans. A, Vol. 248, No. 951, 433-48 (1956).

The potential distribution in the electric double layers of two identical spherical colloidal particles is obtained numerically for cases covering wide ranges of the particle radius, particle separation and surface potential. The method of solution of the Poisson–Boltzmann equation by finite differences in an electronic computer is described and the distributions obtained are used to discuss the accuracy of the approximate methods that have been developed. It is shown that a series of spherical harmonics (which is only valid for low surface potential) is practical only for small particles and large separation, and unless these conditions hold, accurate results may only be obtained by retaining many terms in the series. A

541.182

7793. THE INTERACTION OF TWO IDENTICAL SPHERICA COLLOIDAL PARTICLES. II. THE FREE ENERGY. N.E.Hoskin and S.Levine.
Phil. Trans. A, Vol. 248, No. 951, 449-66 (1956).

By making use of the potential distribution in the electric double layers of two identical spherical colloidal particles, obtained numerically in the preceding abstract, the free energ of interaction of the two particles is calculated on the Manchester University Electronic Computer. Various equivalent formulae for both the interaction energy and the repulsive force are applied and compared. It is demonstrated that for the mesh used here, which is based on dipolar co-ordinates, the most accurate method is that which expresses the force in terms of the potential distribution on the median plane. The method of Derjaguin (1934, 1939) for determining the free energy, which treats two spherical particles as consisting of sections of two infinite parallel plates, is shown to yield a goo approximation over a wide range of the relevant parameters. Three convenient methods of evaluating the free energy, whic are based on the Derjaguin formula, are developed. These ar suitable at (i) large particle separations, (ii) small surface potentials and (iii) large surface potentials. A

541.182.3 : 537.22

7794. STABLE DIPOLE MOMENTS OF AEROSOL PARTICLES. A.A.Spartakov and N.A.Tolstoĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 3 (9), 385 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 2, 329 (March, 1956).

Tobacco smoke particles are shown from their effect on light passing through 3-5 cm of the aerosol, and modulated by the field of a square-wave voltage, to have a stable dipole moment which is considered to arise from orientation of pola molecules (probably water molecules) adsorbed on the surfac of the particles. R.C.Murra

541.183 : 537.311.

7795. ALTERNATING CURRENT CONDUCTIVITY STUDY OF OXYGEN CHEMISORPTION ON PbS. M.Silver and V.R.Honnold.
J. chem. Phys., Vol. 24, No. 6, 1280-1 (June, 1956).

The effect of O_2 on the resistance–frequency behaviour

PbS layer was investigated over the pressure range 3×10^{-7} o 760 mm. The results are tentatively explained by assuming hat there is a distribution of sites of varying activity where hemisorption of oxygen may take place. W.Good

541.183

7796. ADSORPTION SPECTRUM OF NITROGEN ON TUNGTEN. G.Ehrlich and T.W.Hickmott.
Nature (London), Vol. 177, 1045-6 (June 2, 1956).

The state of nitrogen adsorbed on a tungsten filament nitially held at 298°K has been examined by an oscillographic nethod; the temperature T of the filament was raised and the urve of T against pressure of nitrogen evolved was obtained. Four peaks of nitrogen evolution were found, α, 300-600; β, 1400-1500; γ, 140-250; δ, 100-140 (all °K). The heat of adsorption for β is ~ 85 kcal; for γ and δ it is probably of he order found in physical adsorption. S.J.Gregg

541.183.26

7797. BINDING STATES OF DIATOMIC MOLECULES ON TUNGSTEN. T.W.Hickmott and G.Ehrlich.
J. chem. Phys., Vol. 24, No. 6, 1263-4 (June, 1956).

Two temperature regions (~500°K and above 1100°K) are distinguished for the desorption of CO, O_2 and H_2 respectively, indicating two chemisorbed states for each gas. For H_2 the high temperature region is due to atomic hydrogen but the mode of formation of this state is uncertain. G.Allen

CHEMICAL STRUCTURE 541.2/.6

541.24 : 539.374 : 539.319

STRESS RELAXATION IN CONCENTRATED SOLUTIONS OF POLYMETHYL METHACRYLATE: MOLECULAR WEIGHT DEPENDENCE. See Abstr. 6969

CHEMICAL ANALYSIS 543/545

545.8 : 539.17

7798. RADIOACTIVATION ANALYSIS OF PHOSPHORUS IN IODINE. J.A.James and D.H.Richards.
Nature (London), Vol. 177, 1230 (June 30, 1956).

When iodine containing phosphorus is irradiated in a thermal neutron flux, the following reactions occur:

$$I^{127}(n,\gamma)\ I^{128} \xrightarrow{\beta^1 + \gamma} Xe^{128} \quad (t_{1/2} = 25.0 \text{ min.}),$$

$$P^{31}(n,\gamma)\ P^{32} \xrightarrow{\beta^1} S^{32} \quad (t_{1/2} = 14.3 \text{ days}).$$

If time is allowed for the iodine activity to die away, the remaining activity is entirely due to phosphorus (or other long-lived impurities). An analytical method based on this is described. C.B.Allsopp

545.822 : 537.525

REACTIONS IN GAS DISCHARGES WITH THE SPECTROCHEMICAL DETECTION OF NON-METALS THROUGH EXCITATION WITH ULTRA-SHORT WAVES, FOLLOWING (THE METHOD OF) GATTERER AND FRODL. See Abstr. 6670

545.827

7799. LIQUID SCINTILLATION TECHNIQUE FOR MEASURING CARBON-14—DIOXIDE ACTIVITY. J.M.Passmann, N.S.Radin and J.A.D.Cooper.
Analyt. Chem., Vol. 28, No. 4 (I), 484-6 (April, 1956).

A method is described for the determination of C^{14} in large amounts of carbon dioxide using a liquid scintillation counter. The carbon dioxide is dissolved in a toluene—methanol counting medium by diffusing it into a solution of a high molecular weight quaternary ammonium hydroxide. The efficiency of counting is independent of the amount of carbon dioxide, but does depend on the amount of amine. The efficiency ranges from 33% to greater than 67%. A.

CRYSTALLOGRAPHY 548

548.232.4 : 536.421.4

7800. ALLOY DENDRITIC GROWTH. W.A.Tiller.
Canad. J. Phys., Vol. 34, No. 7, 729-30 (July, 1956).

Further details and explanations are given to justify Tiller and Rutter's treatment (Abstr. 1157/1956) of the transition from a cellular to a dendritic interface in a Pb—Sn alloy, with particular reference to a figure in that article. S.Weintroub

548.4

7801. NOTE ON HYDROGEN IN GERMANIUM AND SILICON. J.H.Crawford, Jr, H.C.Schweinler and D.K.Stevens.
J. appl. Phys., Vol. 27, No. 7, 839-40 (July, 1956).

Magnetic susceptibility measurements on Ge and Si crystals, grown in a H atmosphere, indicate that Si contains less than 10^{17} and Ge less than 10^{16} H atoms/cm^3. The hydrogen might be dispersed as molecules in the interstices, or molecule formation may occur between two atoms located in adjacent interstices. J.Franks

548.5

7802. CRYSTAL LATTICE MODELS RESULTING FROM ELECTRICAL CHARGING DURING CRYSTALLIZATION. B.Krause and M.Renninger.
Acta cryst., Vol. 9, Pt 1, 74-81 (Jan., 1956). In German.

Small crystals of pentaerythritol crystallizing from aqueous solution and floating on the surface, if of uniform size, are found forming a regular hexagonal array. This is shown to be caused by the interaction of the capillary attraction and the electrostatic repulsion of negative charges on the growing crystals. The sign of the charge reverses if the crystals, after a period of growth, dissolve again. The potentials to which the crystals are charged can reach several hundred volts and are proportional to the length of the crystal edges. Details of the arrangement can be explained quantitatively by a relation between the edge-lengths of two interacting crystals and their distance. It is surmised, but could not be proved, that the interaction is due to unipolar charges "frozen in" all over the volume rather than to a double layer located at the surface of the crystals. The possible relation of the effect to Ribeiro's thermo-dielectric effect is pointed out. A

548.5

7803. OBTAINING "UNIAXIAL" CRYSTALS OF SYNTHETIC CORUNDUM. N.Yu.Ikornikova and A.A.Popova.
Dokl. Akad. Nauk. SSSR, Vol. 106, No. 3, 460-1 (1956). In Russian.

Investigation of the causes of internal strain in Verneuil-type crystals showed the temperature gradient in the furnace and the position of the growing crystal relative to the isotherm for the melting point of alumina were controlling factors. Strain-free "uniaxial" single crystals were produced in a furnace modified to give a small temperature gradient. These were much less brittle than the strained "biaxial" crystals normally obtained. C.H.L.Goodman

548.5 : 537.311.33

FORMATION OF P-N JUNCTIONS IN SEMICONDUCTORS BY THE VARIATION OF CRYSTAL GROWTH PARAMETERS.
See Abstr. 6629

548.5

7804. THE INFLUENCE OF DIFFUSION ON THE KINETICS OF CRYSTALLIZATION. É.A.Arinshtein.
Zh. éksper. teor. Fiz., Vol. 30, No. 2, 414-16 (1956). In Russian.

The initial propositions of the diffusion theory are thought to be at variance with the Curie–Vulf principle and with certain experimental facts (e.g. limiting rate of growth during intensive mixing). The diffusion equation $\partial c/\partial t + D.\partial^2 c/\partial x^2 = 0$, where c(x, t) = concentration, D = diffusion coefficient, is solved with the initial and boundary conditions $c(x, 0) = c_\infty$, $c(\infty, t) = c_\infty$. Instead of the boundary condition $c(0, t) = c_0$ (saturation concentration) the author uses the rate of growth $V(t) = k[c^n(0, t) - c_0^n]$, where n = order of the process, k = kinetic coefficient. V(t) can be expressed as a series in powers of $t^{1/2}$ by

$V(t) = k(c_\infty^n - c_0^n) - (2n\delta k^2/\sqrt{\pi D}) \cdot c_\infty^{n-1}(c_\infty^n - c_0^n)t^{1/2} + \ldots$

where δ = density of the crystal. The dominant position of diffusion is gained when the solution is exhausted over a sufficiently wide region; it then becomes the retarding influence. A.L.Mackay

548.52

7805. INFLUENCE OF ADSORBED FILMS ON CRYSTAL GROWTH KINETICS. G.W.Sears.
J. chem. Phys., Vol. 25, No. 1, 154-9 (July, 1956).

The growth kinetics of crystals is appreciably altered by strongly adsorbed films. The growth steps are inoperative or poisoned below a critical supersaturation. Since this supersaturation for poisoning is much less than the supersaturation level for two-dimensional nucleation, the effect should only be observable for the growth of imperfect crystals. A.

548.52

7806. A CONTRIBUTION TO THE GROWING OF SINGLE CRYSTALS OF BARIUM TITANATE. J.Beneš, V.Bednářová and Š.Safrata.
Czech. J. Phys., Vol. 6, No. 1, 56-64 (Jan., 1956).

The paper gives an exhaustive survey of the present methods of growing barium titanate by the crystallization of combined melts. A critical appraisal is carried out of the methods using melts with sodium and potassium carbonate and melts with barium chloride. From the results of the experiments the insufficiency of present facts in literature on growing according to the second method was shown. The molar ratio $BaCl_2 : BaCO_3 : TiO_2 = 2 : 2 : 1$ is given as the best ratio for a certain temperature cycle of melting. A description is given of single-domain crystals produced by this melt not containing any other admixtures. A.

548.52

7807. THE GROWTH OF SINGLE CRYSTALS OF BARIUM TITANATE FROM MELTS WITH BARIUM CHLORIDE.
S.Šafrata, V.Bednářová and J.Beneš.
Czech. J. Phys., Vol. 6, No. 2, 185-91 (April, 1956).

On the basis of experiments carried out on the growing of barium titanate single crystals it is shown that the data given by B.T.Matthias (Abstr. 2245/1948) are incomplete and insufficient thus leading in certain cases to negative results. This paper gives the conditions for growing crystals which are suitable for fundamental physical research. A.

548.574

7808. ETCH FIGURES ON SILICON STEEL. F.Kroupa.
Czech. J. Phys., Vol. 5, No. 4, 554-5 (Dec., 1955).

New types observed after anodic etching. Details of treatment are given. J.Adam

548.574

7809. SPIRAL ETCH PITS IN SILICON. W.Bardsley and B.W.Straughan.
J. Electronics, Vol. 1, No. 5, 561-2 (March, 1956).

The etch technique is described. Observations are made on the form of the pits, which are some two microns deep, with a step height of about $\frac{1}{4}$ micron. Two photomicrographs of spirals of opposite hand. W.Bardsley

ATOMIC AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

7810. A NEW AID TO THE DETERMINATION OF THE POINT-GROUP SYMMETRY OF TRANSPARENT CRYSTALS. J.W.Davisson.
Acta. cryst., Vol. 9, Pt 1, 9-15 (Jan., 1956).

The patterns formed by electrical breakdown paths provide a new way to investigate the point-group symmetry of transparent crystals because the paths lie along equivalent directions. A point group is uniquely determined from the observation in a single-crystal slice of non-degenerate breakdown configurations. Such non-degenerate configurations are formed in most monoclinic and in all triclinic crystals, while most crystals of higher symmetry reveal degenerate configurations which are compatible with more than one point group. Degeneracy, however, is not an inherent property of the breakdown process and might be removed by suitable techniques. Since the paths are believed to be formed by electron avalanches, the symmetry shown by the breakdown pattern probably refers to the symmetry of the electrical fields within the crystal that influence the motion of electrons. The symmetry of the breakdown pattern is usually identical with the symmetry of the crystal determined by other methods. A new test for the lack of centrosymmetry in transparent crystals is described. A.

548.7

7811. X-RAY STUDY OF LATTICE VIBRATIONS IN ALUMINUM. C.B.Walker.
Phys. Rev., Vol. 103, No. 3, 547-57 (Aug. 1, 1956).

The diffuse scattering of monochromatic X-rays by a single crystal of aluminium at 300° K has been measured along seven lines in reciprocal space. Analysis of these data in terms of the Laval-James theory has yielded dispersion curves for elastic waves propagating along the three primary symmetry axes. By interpreting these dispersion curves in terms of the Born theory of lattice vibrations, values have been obtained for the nine force constants necessary to describe the general first-, second-, and third-neighbour interactions. These force constants have served as criteria in rejecting the simpler models of atomic interactions generally employed. The secular equation containing these nine force constants has been solved for the eigenfrequencies of 2791 wave vectors by machine computation. These solutions served to establish an approximate frequency spectrum of the normal modes, in which the singularities caused by the critical points are explicitly included. From this spectrum the specific heat is calculated. A comparison with measured specific heats shows the need for the inclusion of anharmonic terms in the theoretical approach. A

548.7 : 536.631

7812. CALCULATION OF THE MEAN DEBYE TEMPERATURE OF CUBIC CRYSTALS. W.P.Binnie.
Phys. Rev., Vol. 103, No. 3, 579-80 (Aug. 1, 1956).

A rapid method of computing the mean Debye characteristic temperatures of anisotropic cubic crystals is described. The method employs the known relationships of the elastic moduli of single and polycrystals of the same material and gives Debye temperatures with an uncertainty of less than 1% when these values are compared with those calculated from more elaborate procedures. A

548.7 : 537.226

7813. DYNAMICS OF IONIC LATTICES OF FERROELECTRIC CRYSTALS IN LIMITING CASES. V.Kh.Kozlovskiĭ. Zh. éksper. teor. Fiz., Vol. 30, No. 4, 766-79 (1956). In Russian.

A method for studying the motion of ions in a ferroelectric is proposed which is not restricted by the magnitude of the anharmonic forces. A ferroelectric in which the ferroelectric-active ions oscillate as a rigid lattice and also coupled oscillations of two rigid lattices are examined. The temperature dependence of the displacements and dispersions is determined and is found to be in qualitative agreement with experiment. Criteria for the number of phase transitions and their nature are established. More precise results have been obtained for the anharmonic vibrator model, it being shown that transitions of the first kind are possible. A ferroelectric model is proposed according to which the ferroelectric contains diatomic ferroelectric-active molecules. A.

548.7 : 539.219

7814. OSCILLATION SPECTRUM OF DISORDERED CRYSTAL LATTICES. I.M.Lifshits and G.I.Stepanova. Zh. éksper. teor. Fiz., Vol. 30, No. 5, 938-46 (1956). In Russian.

A solution of isotopes is examined although the method developed in the paper is applicable to the general case. The masses of the atoms are considered as a random quantity and the deviation of the masses from a certain "basic" value is not assumed to be small. The spectral density and vibrational part of the free energy of the solution are determined. A.

548.7

7815. A NOTE ON THE STRUCTURE OF GUINIER–PRESTON ZONES. K.Toman. Czech. J. Phys., Vol. 5, No. 4, 556-7 (Dec., 1955).

Disagrees with Gerold's (Zeitschrift für Metallkunde, Vol. 45, 599, 1954) model. J.Adam

548.7

7816. ELECTRON-NUCLEAR WAVE FUNCTIONS IN MULTIPHONON PROCESSES. J.J.Markham. Phys. Rev., Vol. 103, No. 3, 588-97 (Aug. 1, 1956).

For most purposes, the wave-functions of a crystal with an electron trapped at an impurity are approximated by the product of two functions, one involving the lattice coordinates and the other the position of the electron. The electronic function may be determined for the equilibrium position of the lattice (static approximation) or one may assume that the electronic wave-function continuously adjusts itself to the instantaneous position of the lattice (adiabatic approximation). The author relates the wave-functions to Hamiltonian operators which do not have some of the most common operational properties. A comparison of the two approximations is made using the variational principle. The static underestimates the kinetic energy and overestimates the potential energy, while the second does just the reverse. Although the formal treatment is quite general and includes all the effects for harmonic vibrations, the actual terms were evaluated for a simple model. The calculations show that for extremely shallow traps the static approximation may be slightly superior, while for deep traps the adiabatic approach should be used. For traps of depths less than 0.1 eV the methods are essentially equivalent; in any actual calculations, other approximations must be made and they are of greater importance than the slight difference between either of these approaches. A.

548.7

7817. THE DENSITY OF ELECTRONIC STATES IN BODY-CENTRED CUBIC CRYSTALS. M.A.E.Nutkins. Proc. Phys. Soc. B, Vol. 69, 619-24 (June, 1956).

The first six Brillouin zones for a metal with a body-centred cubic structure are described in detail. The density of states for each of these zones is found by assuming the electrons to be free. The discontinuities in the energy at points of high symmetry in the Brillouin zone structure are calculated by the approximation of nearly free electrons, and numerical values are obtained for sodium by comparison with the results of Howarth and Jones. The separate N(E) curves for each of the zones are modified in accordance with these values of the energy and the modified total curve is obtained. A.

548.7 : 530.145

CORRELATION EFFECT IN THE POLARON PROBLEM. See Abstr. 6377

548.7

7818. MEAN FREE PATH OF A NON-LOCALIZED EXCITON IN A POLAR CRYSTAL. A.I.Ansel'm and Yu.A.Firsov. Zh. éksper. teor. Fiz., Vol. 30, No. 4, 719-23 (1956). In Russian.

The mean free path due to the interaction between the electron and the hole comprising the exciton and the thermal lattice oscillations has been computed for high and low temperatures. A.

548.7 : 535.337

7819. ZEEMAN EFFECT IN THE YELLOW EXCITON SERIES OF CUPROUS OXIDE CRYSTALS. E.F.Gross, B.P.Zakharchenya and N.M.Reĭnov. Zh. tekh. Fiz., Vol. 26, No. 3, 700-1 (1956). In Russian.

With dispersion 1.5 A/mm, H = 27 000 oersted at 1.3°K the Zeeman components of the n = 3,4,5,6 terms of the exciton spectrum of Cu_2O (Abstr. 6481/1954) were resolved. D.H.Whiffen

548.7 : 535.37

POLARIZED LUMINESCENCE OF CUBIC CRYSTALS. See Abstr. 6534

548.7

7820. THERMAL DISSOCIATION ENERGY AND THE BASIC STATE OF F_2^+ CENTRES. M.Trlifaj. Czech. J. Phys., Vol. 6, No. 2, 99-107 (April, 1956). In Russian.

The system consisting of an electron plus two adjacent vacancies left by halogen ions in crystals of alkali halides is investigated on the basis of quantum mechanics. It is shown that the mutual interaction of the electron with the vacancies and with the crystal leads to the creation of a stable system called by Seitz an F_2^+ centre. The thermal dissociation energy and the parameters of the basic state of the F_2^+ centre are determined. It is shown on the basis of these calculations that F_2^+ centres in crystals of alkali halides are thermally less stable than F_2 centres. A.

548.7

7821. TRANSFORMATIONS OF VARIOUS CENTRES AMONG EACH OTHER IN COLOURED ALKALI-HALIDE CRYSTALS. H.Yagi. J. Phys. Soc. Japan, Vol. 11, No. 7, 723-7 (July, 1956).

Photo-thermal transformations among various centres in coloured alkali-halide crystals are studied here collectively. A.

548.7

7822. X-RAY COLORATION OF SENSITIZED KBr, KBr(Ag) AND KCl CRYSTALS AT DIFFERENT QUANTUM ENERGIES. H.Leutz. Z. Phys., Vol. 145, No. 4, 412-20 (1956). In German.

KBr, KBr(Ag) and KCl, sensitized by 10^{17} U centres per c.c. were coloured by X-rays. Dependence of coloration on X-ray dosage in the linear region of the coloration curve was determined for various X-ray tube potentials. The energy of formation per F-centre was smallest at low quantum energies. For silver-activated KBr the F-centres formed per unit dose were 1.8 times more numerous than those in pure KBr for the same dose. G.F.J.Garlick

548.7

7823. TWO-DIMENSIONAL MOTION OF IDEALIZED GRAIN BOUNDARIES. W.W.Mullins.
J. appl. Phys., Vol. 27, No. 8, 900-4 (Aug., 1956).

To represent ideal grain boundary motion in two dimensions, a rule of motion of plane curves is considered whereby any given point of a curve moves toward its centre of curvature with a speed that is proportional to the curvature. A general theorem is deduced concerning the change of area enclosed by such a curve. Three families of curves are found that obey the curvature rule of motion while undergoing the shape preserving transformations of uniform magnification, translation, and rotation respectively. Pieces of these curves represent the steady shapes of idealized grain boundaries under certain symmetrical conditions. A.

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.732 : 537.531.85

INTENSITY OF X-RAY SCATTERING BY THE COMPTON EFFECT IN ALUMINIUM. See Abstr. 6688

548.733

7824. A REVIEW OF PROGRESS MADE IN THE CONSTRUCTION OF X-RAY TUBES FOR CRYSTALLOGRAPHY. S.Goldsztaub.
Acta cryst., Vol. 9, Pt 2, 118-20 (Feb., 1956). In French.

A review is given of crystallographic X-ray tubes recently designed with the object of reducing exposure times. For this purpose a source of high brilliance, rather than of high power, is required so that research has been directed to reducing the size of the focal spot. There is, however, an optimum size of focus and no advantage is gained in using smaller foci than this optimum size. A.

548.733

7825. SOME APPLICATIONS OF FOCUSING OF X-RAYS BY TOTAL REFLECTION. M.Montel.
C.R. Acad. Sci. (Paris), Vol. 242, No. 20, 2453-5 (May 14, 1956). In French.

See Abstr. 9285 (1954) for description of focusing device. It can be applied to collimation of X-rays so as to reduce exposure time, irradiation of a small area of a crystal specimen, and partial monochromatization. A.R.Stokes

548.733

7826. AN X-RAY DIFFRACTION METHOD FOR THE STUDY OF FORMATION AND STRUCTURE OF SURFACE FILMS. J.J.Trillat.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3089-92 (June 25, 1956). In French.

Describes a new X-ray camera. The primary beam falls tangentially upon the uppermost part of a rotating glass or metal horizontal cyclinder which is partially immersed in the liquid under examination. Diffraction pattern produced by thin film adhering to the cylinder is recorded photographically. Provision is made for heating or cooling the samples. Several applications are suggested. J.Adam

548.733

7827. A SCANNING X-RAY CAMERA FOR THE DETECTION OF CRYSTAL IMPERFECTIONS. P.J.Holmes.
J. Electronics, Vol. 1, No. 3, 324-6 (Nov., 1955).

A simple mechanism gives a slow continuous specimen motion in a line parallel to the film. Typical back-reflection Laue photographs showing the presence of lattice imperfections in germanium single crystals are reproduced. J.Adam

548.734

7828. THREE EXAMPLES OF ACCURATE CRYSTAL-STRUCTURE ANALYSIS BY LOW-TEMPERATURE X-RAY PHOTOGRAPHY. F.L.Hirshfeld and G.M.J.Schmidt.
Acta cryst., Vol. 9, Pt 3, 233-6 (March, 1956).

Accurate structure determinations, even by two-dimensional methods, and the approximate location of hydrogen atoms are made possible by the technique of cooling the crystals in boiling nitrogen during photography. The method is illustrated by three structures that have been refined, each in one projection, to an accuracy estimated at better than 0.005 A in each coordinate. A.

548.734

7829. ANOMALOUS ENHANCEMENT OF X-RAY REFLECTION INTENSITY AT THE BOUNDARY OF GROUND AND ETCHED REGIONS ON CRYSTAL SURFACE. N.Kato.
J. Phys. Soc. Japan, Vol. 11, No. 7, 748-54 (July, 1956).

The anomalous effect reported by Fukushima (Abstr. 8784/1954), i.e. a large enhancement of X-ray reflection intensity at the boundary of etched and ground regions in quartz crystal slab, is studied by a double crystal spectrometer. The difference cannot be found in line width of reflection curves at the ground region and at the boundary region. Lattice bending is not detected at the boundary. It is not larger than 10", if it exists. The anomalous enhancement is erased by etching the crystal surface for several seconds. This anomalous effect can be observed also in $NaClO_3$ crystal and calcite but the enhancement is very small in the latter crystal. It is concluded that the anomalous enhancement is due to a reduction of primary extinction caused by elastic distortion accumulated at the boundary region. A.

548.734 : 537.531

BACK-REFLECTION DETERMINATION OF SMALL VARIATIONS IN EMISSION SPECTRUM OF Co COMPOUNDS. See Abstr. 6682

548.734.3

7830. X-RAY POWDER DIAGRAMS WITH VARIABLE RADIUS. G.E.Éfendiev.
Zh. tekh. Fiz., Vol. 26, No. 3, 646-8 (1956). In Russian.

If the powder specimen in a circular X-ray powder camera is mounted at a position displaced from the centre of the camera in the direction of the X-ray tube, then the resolving power at low angles can be increased and lines of longer spacing recorded. A.L.Mackay

548.734.8

7831. AN APPARENT ANISOTROPIC DEBYE-WALLER FACTOR IN CUBIC CRYSTALS. R.J.Weiss, J.J.DeMarco, G.Weremchuk, L.Corliss and J.Hastings.
Acta. cryst., Vol. 9, Pt 1, 42-4 (Jan., 1956).

Neutron and X-ray diffraction studies on α-brass (70-30 f.c.c.) have revealed that the integrated intensities are reduced by a Debye—Waller temperature factor $\exp(-2B(\sin\theta/\lambda)^2)$, where B is not only a function of the characteristic temperature θ and the absolute temperature T, but also a function of crystal direction, contrary to present theories for cubic crystals. The effect is very marked in comparing the 222 and 400 peaks both as to their relative intensities and their change in intensity with temperature from liquid nitrogen to room temperatures. A.

548.735

7832. THE DETERMINATION OF THE PHASES OF THE STRUCTURE FACTORS OF NON-CENTROSYMMETRIC CRYSTALS BY THE METHOD OF DOUBLE ISOMORPHOUS REPLACEMENT. D.Harker.
Acta cryst., Vol. 9, Pt 1, 1-9 (Jan., 1956).

It is shown that the complete structure of a non-centrosymmetric crystal can be determined from the X-ray diffraction data obtained from the members of an isomorphous series

in which two different parts of the structure can be varied independently. The structure so determined may be an enantiomorph of the true structure. A.

548.735

7833. STRUCTURE INVARIANTS AND SEMINVARIANTS FOR NON-CENTROSYMMETRIC SPACE GROUPS.
H.Hauptman and J.Karle.
Acta. cryst., Vol. 9, Pt 1, 45-55 (Jan., 1956).

The nature of the dependence of phase on the choice of origin is clarified for the non-centrosymmetric space groups by means of special linear combinations of the phases, the structure invariants and seminvariants. The theory yields simple answers to the following questions: Which phases have values determined uniquely by the crystal structure and independent of the choice of origin? If the values of certain phases are specified, what phases have values which are then uniquely determined by the structure? The values of which phases are to be specified in order to fix the origin uniquely? Simple procedures for fixing the origin by suitably specifying the values of certain phases are described in detail. A.

548.735

7834. DETERMINATION OF THE STRUCTURE OF Ti_2CaO_4 BY THE SELF-CONSISTENT METHOD OF DIRECT APPROACH. E.F.Bertaut and P.Blum.
Acta cryst., Vol. 9, Pt 2, 121-6 (Feb., 1956). In French.

A discussion is given of the statistical method of direct approach in structure determination. In principle this method resolves the problem of the determination of a structure when the chemical formula is unknown. The method is applied to the determination of the structure of Ti_2CaO_4. A.

548.735

7835. THE ACCURACY OF ATOMIC CO-ORDINATES DERIVED FROM FOURIER SYNTHESES. G.J.Dickins.
Acta cryst., Vol. 9, Pt 2, 201 (Feb., 1956).

The statistical method of calculating peak atomic positions is shown to give positions that do not always agree with those found graphically. In the case of σ-CoCr it is found that four calculated positions and the graphical position may all be enclosed within a circle of radius 0.001 of the cell edge, i.e. about 0.01 A. J.Thewlis

548.735

7836. SCATTERING OF X-RAYS BY DEFECT STRUCTURES.
W.Cochran.
Acta cryst., Vol. 9, Pt 3, 259-62 (March, 1956).

The intensity of X-ray scattering from a crystal containing defects is shown to depend in a simple way on the Fourier transforms of the defects considered separately. An example of the application of the theory is worked out. A.

548.735

7837. CRYSTAL STRUCTURE REFINEMENT BY LEAST-SQUARES WITH THE ELECTRODATA COMPUTER.
L.R.Lavine and J.S.Rollett.
Acta cryst., Vol. 9, Pt 3, 269-73 (March, 1956).

Two programmes have been coded and used for least-squares refinement by the ElectroData digital computer with three-dimensional data for crystal structures of classes 2/m and 222. Relevant details of the computer are given. The method of calculation and the forms of input and output are described. The rate of operation of each programme is stated. An expression for predicting the value of the minimization function has been tested. A.

548.735

7838. K-SURFACES AND DIFFUSE X-RAY REFLEXIONS.
S.C.Prasad and W.A.Wooster.
Acta cryst., Vol. 9, Pt 3, 304-8 (March, 1956).

The diffuse X-ray scattering from a crystal varies with direction of the wave normal of the scattering wave according to a K-factor. The method of calculating and plotting the corresponding K-surface on a stereogram is described. The construction of differential K-surfaces, for the study of the variation with the elastic constants of the K-values, is also described. Examples are given of a number of K-surfaces for tungsten, lead, iron pyrites and tin. The use of K-surfaces in the interpretation of diffuse spots on X-ray photographs is described. A.

548.735

7839. CERTAIN FUNCTIONS WORTHY OF CONSIDERATION IN CRYSTAL STRUCTURE DETERMINATION.
J.Clastre, R.Gay, J.Housty and P.Romain.
Bull Soc. Franç. Minéral. Crist., Vol. 79, No. 4-6, 301-13 (April-June, 1956). In French.

Interesting properties of Fourier transforms of a series of absolute values, a cube series and a sign series of structure factors are analysed. Applications of these functions in the refining stages of structure analysis are indicated. J.Adam

548.735

7840. A SIMPLE FORMULA FOR EVALUATING THE MADELUNG CONSTANT OF A NaCl-TYPE CRYSTAL.
G.C.Benson.
Canad. J. Phys., Vol. 34, No. 8, 888-90 (Aug., 1956).

The formula is a double sum; its derivation is given and its rapid convergence demonstrated. A.R.Stokes

548.735

7841. A STATISTICAL METHOD FOR THE DETERMINATION OF THE SIGNS OF STRUCTURE FACTORS.
M.Simerská.
Czech. J. Phys., Vol. 6, No. 1, 1-7 (Jan., 1956).

The average value of the products of a certain number of unitary structure factors was developed for a constant sum of their Miller indices. Its determination gives the measure of the usefulness of the statistical relations which connect the sign of a certain structure factor and the sign of the product of an arbitrary number of structure factors. A.

548.735

7842. A CONTRIBUTION TO THE DETERMINATION OF LATTICE CONSTANTS BY THE DEBYE-SCHERRER METHOD.
S.Ďurovič.
Czech. J. Phys., Vol. 6, No. 3, 293-8 (June, 1956). In Russian.

On the assumption that there is at our disposal a single crystal of the material under test permitting goniometric measurements, which gives the ratio of the axes and the inter-axial angles, the enumeration of the dimensions of its lattice can be carried out by means of a single debyegram. The method starts out from the fact that as the dimensions of the lattice vary with constant inter-axial angles n times, the corresponding d_{hkl} also varies n times. This circumstance can be used to find the distances D_{hkl} corresponding to the lattice constructed on vectors, the magnitudes of which are equal to the numerical values of the ratio of the axes. These values are plotted in a graph on a line parallel to the axis of the abscissae going through the point (10) and are joined to the origin. A straight-line graph is then obtained where to every set of triple indices hkl there corresponds to a particular line. From the debyegram of the specimen the values of d are calculated and marked to the same scale as that used on the axis of abscissae onto a strip of paper which is placed on the graph and shifted parallel to the axis of abscissae till the marks on the strip cover the lines on the graph. The position of the strip then directly determines the true magnitude of the lattice constant b. At the same time the corresponding symbols are assigned to the lines of the debyegram which permits the determination of the space group. Due to the fact that in the asymmetric systems the calculation of the set of values D_{hkl} is very tedious a modified Peacock method was used for the graphical determination of these values from the reciprocal lattice. The method was applied to topaz and adequate agreement with data given in the literature for this material was obtained. A.

548.735

7843. PRECISION DETERMINATION OF LATTICE CONSTANTS. H.Weyerer.
Z. angew. Phys., Vol. 8, No. 6, 297-9 (1956). In German.

See Abstr. 6258 (1956). The use of a symmetrical focusing camera is discussed, and the measurement of the lattice constant of gold is described. The value obtained is 4.070107 + 0.000008 kX (not corrected for refraction) at 25° C.
A.R.Stokes

548.735

7844. THE METHODOLOGY OF THE X-RAY STUDY OF TEXTURED POLYCRYSTALLINE SPECIMENS. D.M.Vasil'ev.
Zh. tekh. Fiz., Vol. 26, No. 3, 695-7 (1956). In Russian.

In powder photographs the presence of axial textures causes variations in the intensities and widths of reflections in the equatorial plane which confuse the measurement of distortions. Rotating the specimen about a line in the equatorial plane which makes an angle θ with the beam removes the effects of axial texture for reflections with Bragg angles near θ.
A.L.Mackay

548.736.1

7845. THE ANOMALOUS X-RAY BACKGROUND SCATTERING FROM β-TIN. S.C.Prasad and W.A.Wooster.
Acta. cryst., Vol. 9, Pt 1, 35-7 (Jan., 1956).

White tin shows anomalous diffuse X-ray scattering corresponding to points in reciprocal space distributed over volumes large compared with those associated with thermal diffuse scattering. A detailed study has been made of the volumes surrounding the reciprocal lattice points 400 and 103, and it is shown that the scattering volume is in the form of plates passing through the points 400 and 103 and normal to the x and z axes respectively. A tentative explanation of the phenomenon is given in terms of static distortions of the lattice.
A.

548.736.4 : 548.74

7846. X-RAY AND NEUTRON DIFFRACTION STUDY OF FERROELECTRIC $PbTiO_3$. G.Shirane, R.Pepinsky and B.C.Frazer.
Acta cryst., Vol. 9, Pt 2, 131-40 (Feb., 1956).

X-ray single-crystal and neutron powder diffraction analyses of tetragonal PbTiO at room temperature reveal the following coordinate shifts of the Ti and O atoms from perovskite positions, with Pb taken at the origin of the pseudo-perovskite cell: $\delta z_{Ti} = +0.040$, $\delta z_{O\,I} = +0.112$, $\delta z_{O\,II} = +0.112$. The equivalence of $\delta z_{O\,I}$ and $\delta z_{O\,II}$ suggests that the oxygen octahedra may be considered as "fixed" in the lattice as the crystal passes from the cubic paraelectric phase above 490° C to the tetragonal ferroelectric structure which it maintains below this temperature. With the oxygens defining the cell, the Pb ions are shifted by +0.47 A along the z axis, and the Ti ions move in the same direction by 0.30 A. This structure is compared to previous results of X-ray and recent neutron single-crystal studies of tetragonal $BaTiO_3$.
A.

548.736.4

7847. AN EXPLANATION OF THE STRUCTURES OF HEXAGONAL BARIUM TITANATE AND TITANIUM DIOXIDE. P.Vousden.
Acta cryst., Vol. 9, Pt 2, 141-2 (Feb., 1956).

The structure of hexagonal barium titanate is explained in terms of the semipolar nature of the Ti–O bond, and the Ti–O and Ba–O bond distances. The brookite and anatase forms of TiO_2 are explained by bond-angle considerations.
A.

548.736.4

7848. HIGH-TEMPERATURE STRUCTURE TRANSITIONS IN SODIUM NIOBATE. M.H.Francombe.
Acta cryst., Vol. 9, Pt 3, 256-8 (March, 1956).

A detailed X-ray "powder" study of sodium niobate at high temperatures has confirmed the conclusion, reached from optical investigations on single crystals, that the crystal structure does not become strictly cubic until the temperature reaches 650° C. At temperatures between 420° C and 480° C the X-ray evidence is consistent with a slightly distorted multiple unit cell with a tetragonal axial ratio very near to 2. At temperatures above 480° C tetragonal-type diffraction line splitting reappears and the axial ratio increases to 2.0038 at 560° C. This effect is accompanied by a reduction in the intensity of superlattice reflections. At 640° C both these reflections and the line splitting disappear, indicating a completely isotropic perovskite-type structure. An explanation of the X-ray effects is suggested in terms of atomic displacements.
A.

548.74

7849. A NEW RATIONALE OF STRUCTURE-FACTOR MEASUREMENT IN NEUTRON-DIFFRACTION ANALYSIS. R.D.Lowde.
Acta. cryst., Vol. 9, Pt 2, 151-5 (Feb., 1956).

The Laue method of recording integrated intensities, with certain adjuncts, appears to be in many ways simpler than the rotating-crystal method for single-crystal neutron diffraction analysis, at the same time as offering increased intensities. A proposed technique is discussed, which is particularly suitable for use with pulsed neutron sources such as electron accelerators.
A.

548.74

7850. IMPERFECTION PHENOMENA IN ELECTRON-DIFFRACTION DIAGRAMS (ON THE MEANING OF CONTINUOUS STREAKS AND TWIN REFLECTIONS). H.Göttsche.
Acta cryst., Vol. 9, Pt 2, 179-81 (Feb., 1956). In German.

In electron-diffraction diagrams of thin plates of cubic face-centred metals prominent continuous streaks are observed along the directions of body diagonals of the reciprocal lattice in addition to the interference effects due to twinned crystals. The application of Jagodzinski's theory of diffraction by a disordered lattice leads to a satisfactory interpretation of the streaks and of the twin reflections, since the twin formation can be treated as one-dimensional disorder.
A.

548.74

7851. ON THE EVALUATION AND THE POSSIBILITY OF CORRECTION OF DIFFRACTION PATTERNS IN THE BOERSCH RAY SYSTEM. E.Gütter.
Optik, Vol. 13, No. 7, 289-94 (1956). In German.

Electron diffraction patterns may be produced in the electron microscope by means of an extra lens. Aberrations spoil the usual simple relation between ring radii and Bragg angles, and necessitates a separate calibration curve for each specified acceleration voltage. It is possible, however, to cancel the effect of distortion in the diffraction and projector lenses by adjustment of the spherical aberration of the objective lens, so restoring the simple radius–Bragg angle relation.
A.E.I. Research Laboratory

548.74

7852. AN ELECTRON DIFFRACTION APPARATUS FOR FINE STRUCTURE INVESTIGATIONS. H.Ehlers.
Z. Naturforsch., Vol. 11a, No. 5, 359-67 (May, 1956). In German.

A high-resolution electron diffraction apparatus has been constructed, for investigating the fine structure of diffraction spots and rings. A fine electron beam, focused at the photographic plate, is obtained by means of two magnetic lenses. Theoretical considerations confirm the experimental finding that the size of the fine focus, in the absence of a specimen, cannot be less than a value of several μ as determined by the properties of the photographic emulsion. In the presence of a specimen, the size of the diffraction spots is in general determined by the size of the crystallites in the specimen.
V.E.Cosslett

548.74

7853. THE FINE STRUCTURE OF ELECTRON DIFFRACTION PATTERNS. H.Ehlers.
Z. Naturforsch., Vol. 11a, No. 5, 368-72 (May, 1956). In German.

The electron diffraction apparatus described in the preceding abstract has been used to study the fine structure of diffraction patterns under various conditions. Secondary maxima were observed in rotation patterns from mica films, and were still well separated in films as thin as 180 A. The size and form of the reflections from several other substances (Al, Ge, KCl, NaCl, Ag, Fe, Ni) are reported. The increase in lattice constant of Al films on heating was determined from the spot pattern. The mean value was found to be 27×10^{-6} per °C over the range 100°C to 500°C, in agreement with the coefficient of linear expansion of Al. V.E.Cosslett

GEOPHYSICS 55

550.341

7854. DYNAMIC MAGNIFICATION OF THE GALITZIN SEISMOGRAPH EXCITED BY SHOCK MOTION OF THE GROUND. V.Tobyáš.
Czech. J. Phys., Vol. 6, No. 1, 22-8 (Jan., 1956).

A reduced dynamic magnification of the first maximum is derived for the seismograph of B.B. Galitzin during shock motion of the ground represented by the expression $At^3e^{-\lambda t}$. A.

550.367 : 539.16

7855. ON THE THERMAL HISTORY OF THE EARTH AND ITS GEOPHYSICAL CONSEQUENCES. E.A.Lyubimova.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 1, 55-8 (1956). In Russian.

Relates the heat flow to the earth's surface due to radioactivity in the core to theories of the earth's formation and history. J.M.Hough

550.378

7856. RADIOMETRY IN GEOPHYSICS. J.Bačkovský and R.Seidl.
Czech. J. Phys., Vol. 6, No. 1, 75-83 (Jan., 1956). In Russian.

From experience gained during numerous field surveys it follows that: (1) The construction of portable instruments and auxiliary equipment for the relative measurement of radioactivity of the soil have proved useful both from the point of view of technical applicability and economy as well as from the point of view of sensitivity, reproducibility and speed of measurement. (2) The use of G-M counters sensitive to β-rays in a vertical position in shallow holes drilled in the soil increased the share of the soil radiation and lowered the relative influence of cosmic ray background on the results of measurements. (3) The conditions for the reproducibility of measurement in the field were determined. (4) A method of standardizing results was worked out for the simultaneous use of several instruments having a different relative sensitivity of various kinds of radiation. (5) Radiometric mapping along lines having the same activity was carried out to eliminate the effect of isolated deviations caused by local conditions and to ensure a more reliable interpretation of the results of measurements. (6) It was shown by practical examples that by the radiometric method under suitable conditions it is possible to localize the position of tectonic faults or contacts of rocks having different activity even on covered formations. (7) Water and its motion in the earth has a considerable effect on the origin of radioactive anomalies. (8) A correlation was found to exist between the chemical composition and the activity of the rock in a bed of manganese pyrite ore. A.

550.38

7857. ON THE PART OF THE GEOMAGNETIC FIELD IN THE ARCTIC REGION AND THE WORLD OCEAN, WHICH IS ASYMMETRIC WITH RESPECT TO THE EARTH'S AXIS. L.A.Korneva.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 679-82 (1956). In Russian.

Describes the anomalous magnetic field in terms of an equivalent electric current; gives diagrams of these currents for 1954. J.M.Hough

550.382.3

7858. ACTION OF ALTERNATING FIELDS ON ROCKS CARRYING ISOTHERMAL REMANENT MAGNETISM. F.Rimbert.
C.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2536-8 (May 23, 1956). In French.

Many samples of rock of different origin were tested in a continuous field of 2-100 Oe for times from a few seconds to 2 months. The magnetization was measured one minute after suppression of the field and then tested in an alternating field of increasing strength to find the field, H_0, which causes complete demagnetization. Uncertainty exists near to H_0 because the field is then so weak. It was found that (1) the magnetic field acquired is practically independent of the time between suppression of the field and the start of demagnetization, (2) for a given magnetic field, the value of H_0 varies linearly as a logarithmic function of the time, (3) for increasing magnetic fields the relative effect becomes less and less feeble, (4) for 4 different volcanic rocks H_0 is independent of the nature of the rock. The results are considered to have application in the domain of paleomagnetism. R.S.Read

550.385

7859. THE DIURNAL BEHAVIOR OF SUDDEN COMMENCEMENTS OF MAGNETIC STORMS AT AGINCOURT. J.A.Jacobs and T.Obayashi.
Canad. J. Phys., Vol. 34, No. 8, 876-83 (Aug., 1956).

The diurnal variations in the frequencies of sudden commencements of magnetic storms are examined, using the magnetograms from Agincourt for the period from 1946 to 1953 inclusive. The occurrence frequencies of sudden commencements exhibit an apparent diurnal tendency which has it minimum in the morning hours and maximum in the afternoon. The frequency distributions for several groups classified by their amplitudes, however, show different diurnal variations from one another. In order to confirm such local-time effects, a statistical analysis of the shape of sudden commencements has been made and each sudden commencement classified according to its shape. Results show the following diurnal characteristics. A pronounced augmentation of the sudden commencement impulse occurs in the afternoon hours. In the morning the initial rise of sudden commencements is usually slight and they are frequently inverted in the H-trace, although some of them are quite clear in the D-trace. The local-time variation of the horizontal magnetic vectors at several stages of the initial phase is also estimated statistically. These results suggest that the diurnal control of the magnetic variation must be due to some additional field produced in the earth's upper atmosphere at the time of sudden commencement, tending to modify the primary cause. A.

550.387

7860. INDUCTION IN THE CORE BY MAGNETIC STORMS AND EARTH'S MAGNETISM. J.S.Chatterjee.

Sci. and Culture, Vol. 21, No. 10, 623-4 (April, 1956).

An examination is made of the effect of the rate of change of the inducing field and the conductivity and permeability of the body of the earth on the depth of penetration of currents caused by magnetic storms. Values are first quoted for the conductivity of the inner solid core, the intermediate fluid core and the outer solid mantle and crust. For the initial phase of a storm the penetration is only 850 km and the current becomes small in a few hours. For the main phase the penetration is 2000 km and the relaxation time about one year. As magnetic storms recur every 27 days the induced current is never quite lost below about 700 km. In the fluid core with a relaxation time of 1500 years the current builds up until the rate of loss of energy equals the rate of supply by storms. This rate of loss is calculated, and it is shown that the integrated strength of the induced currents due to magnetic storms is large enough to explain the observed magnetic moment of the earth. Also with magnetic materials, highly permeable in a shell 20 km thick, the shell will be magnetized to saturation by the cumulative magnetizing effect of the fields of great storms. R.S.Read

550.837.7

7861. GEOPHYSICAL PROSPECTION OF UNDERGROUND WATER IN THE DESERT BY MEANS OF ELECTROMAGNETIC INTERFERENCE FRINGES. M.A.H.El-Said.
Proc. Inst. Radio Engrs, Vol. 44, No. 1, 24-30 (Jan., 1956).

The method consists principally of diffusing electromagnetic energy into the underground medium and into the surface by means of a continuous wave transmitter having its aerial laid on the ground surface. A suitable radio receiver is placed at a known distance from the transmitter and has its aerial similarly laid on the ground surface for the measurement of field strength. With an underground reflecting medium such as a water layer, the wave travelling into the ground will be reflected back to the surface. The field strength at the surface will be the resultant of the surface and underground reflected waves. A phase difference results from the waves having different velocities but the same path length, or different path lengths and the same velocity or a combination of both. Choosing conditions such that the two waves are of the same order of intensity, and the frequency at the transmitter varied slowly through a suitable range, the resultant field strength will undergo maxima and minima at a regular period. If the transmitter frequency is fixed but the distance from the transmitter is varied over a suitable range, the resultant field strength at the moving receiver will diminish with increasing distance but will undergo maxima and minima. These fringes are used to indicate the existence of an underground water layer and to determine its depth below ground. The theory and technique of these two methods is given. Tests were made at two places in the Egyptian desert, the depth of the water layer for one being known, and good agreement between theory and experiment was obtained. R.S.Read

ATMOSPHERE. METEOROLOGY 551.5

551.508.25

7862. "BLACK BALL": A DEVICE FOR MEASURING ATMOSPHERIC INFRARED RADIATION. J.L.Gergen.
Rev. sci. Instrum., Vol. 27, No. 7, 453-60 (July, 1956).

The problem of the atmospheric infrared heat balance has been solved graphically and analytically, but almost no experimental evidence exists to verify the calculations. The "Black Ball" is a device which can be flown on an ordinary radiosonde and indicates a temperature which is related to the total incident infrared flux at any point. The actually observed temperatures must be corrected for convection effects and thermal time constants. Construction and correction data are given. A.

551.508.71

7863. A CAPACITANCE–RESISTANCE HYGROMETER. J.Macdowell; C.L.Cutting, A.C.Jason and J.L.Wood.
J. sci. Instrum., Vol. 33, No. 7, 284-5 (July, 1956).

The theory of the anodized aluminium hygrometer proposed by Cutting, Jason and Wood (Abstr. 2720/1956) is criticized on the basis of cathode ray oscillograms taken while subjecting the hygrometer to charge/discharge cycles at the rate of 50 per second. The traces show that the discharge current has a component of time constant around one second, and a re-charging phenomenon is also observed. The equivalent circuit proposed in the theory is inadequate to explain this behaviour.

In reply, Cutting, Jason and Wood confirm having found similar behaviour and describe further tests carried out to elucidate the reasons. Their theory, however, is based on a.c. bridge measurements using a low voltage, and the equivalent circuit proposed is adequate to represent the element characteristics over a range of relative humidities under this condition. K.W.Plessner

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.510.535 : 523.78

7864. SOLAR ECLIPSES AND THE IONOSPHERE. Edited by W.J.G.Beynon and G.M.Brown.
London: The Pergamon Press (1956) 300 pp. (Supplement to the Journal of the Atmospheric and Terrestrial Physics).

For abstracts see Abstr. 6299-304, 6315-16, 6318, 6747, 7036-9, 7041, 7043-77, 7091-2 (1956).

551.510.535

7865. IONOSPHERIC RECORDERS AND SPORADIC E. J.A.Thomas, A.C.Svenson and H.E.Brown.
Austral. J. Phys., Vol. 9, No. 1, 159-61 (March, 1956).

Repetitive sequences of P'f records taken with different receiver gains at Brisbane show that the two frequencies fEs and FbEs are not dependent on receiver sensitivity. This is true for both the sequential-type and constant height-type of Es. G.M.Brown

551.510.535

7866. PROCESSES CONTROLLING IONIZATION DISTRIBUTION IN THE F2 REGION OF THE IONOSPHERE. D.F.Martyn.
Austral. J. Phys., Vol. 9, No. 1, 161-5 (March, 1956).

An investigation of the possible effects of diffusion of F2 ionization under gravity and partial pressure gradient. It is found that a region of any initial shape will in time assume, by diffusion, the form of a Chapman-like region. Consistent interpretation of many F2-phenomena is possible on the assumption that the atmospheric densities derived from radio data are correct. This suggests that the much lower densities derived from rocket measurements are subject to a systematic error. G.M.Brown

551.510.535

7867. ELECTRON DISTRIBUTION IN THE IONOSPHERE. G.A.M.King and C.H.Cummack.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 270-3 (May, 1956).

Analysis of h', f records to give true heights suggests that the ionosphere consists of three Chapman layers, E, F1, and F2 and that the temperature is uniform. A.

551.510.535

7868. A CORRELATION TREATMENT OF FADING SIGNALS. N.F.Barber
J. atmos. terrest. Phys., Vol. 8, No. 6, 318-30 (June, 1956).

The fading signals observed at spaced receivers are examined in terms of the complete correlogram. Two practical examples are discussed. A.

551.510.535

7869. THE DISTRIBUTION OF ELECTRONS IN THE UNDISTURBED F_2 LAYER OF THE IONOSPHERE. E.R.Schmerling and J.O.Thomas.
Phil. Trans. A, Vol. 248, No. 956, 609-20 (1956).

h'(f) curves recorded at Watheroo, Huancayo and Slough near midwinter, midsummer and equinox in years of sunspot maximum and minimum have been analysed so as to provide N(h) curves which show the electron density (N) as a function of the height (h). The method of analysis is described and its limitations are discussed. The earth's magnetic field has been neglected in the calculations; although this may lead to an error in some of the actual heights quoted, it should not cause appreciable error in the variation of those heights. Curves for the "international magnetically quietest days" in each of the months analysed are considered, and it is shown how, by a process of averaging, it is possible to deduce the form of a "mean quiet F layer". This represents the basic behaviour of the region on magnetically quiet days without those details which are peculiar to any one day. The resulting "mean quiet F layers" are described in a series of curves. A.

551.510.535

7870. THE RATES OF PRODUCTION AND LOSS OF ELECTRONS IN THE F REGION OF THE IONOSPHERE. J.A.Ratcliffe, E.R.Schmerling, C.S.G.K.Setty and J.O.Thomas. Phil. Trans. A, Vol. 248, No. 956, 621-42 (1956).

The distributions referred to in the preceding abstract are used as experimental facts from which the rates of production and loss of electrons are deduced. Use is also made of electron distributions determined, in rapid succession, near sunrise at Cambridge. It is here recognized that there may be important vertical movements of the electrons in the F region, but no assumptions are made about their magnitudes. Methods of analysis are used which minimize their effects. It is shown that the behaviour of the quiet F layer, above 240 km, at the three places mentioned, at all times of the day, the year, and the solar cycle, is more consistent with the supposition that the rate of loss of electrons is given by $-dN/dt = K_1N$ rather than by $-dN/dt = K_2N^2$. Between eights of about 250 and 350 km the loss coefficient K_1 seems to vary with height as given approximately by

$$K_1 = 10^{-4} \exp\left\{\frac{300 - h\ (\mathrm{km})}{50}\right\} s^{-1}.$$

The significance of this type of loss coefficient is discussed. It is realized that, if the above-mentioned loss coefficient were the correct one, then, because it decreases rapidly upwards, it could give rise to a peak of electron density considerably above the peak of electron production. This leads us to consider in detail the hypothesis of Bradbury (1938) that the F_1 and F_2 layers are both produced by the same ionizing radiation, acting on the same atmospheric constituent, and that the two peaks of electron density are caused by a suitable height variation of the loss coefficient. This hypothesis is discussed critically, in relation to the experimental results, and is shown to be self-consistent. It is shown that, if Bradbury's hypothesis is accepted as correct, the scale height of the ionizable constituent between 180 and 350 km is about 45 km. This is in better agreement with the R model of the upper atmosphere deduced by Bates (1954) from the results of rocket experiments, than with the G model deduced from the results of experiments made on the ground. It is also shown how the experimental results lead to the deduction of limits to the movements caused by the diffusion of electrons under gravity. The movements expected on Bates's R model are greater than those deduced from the experiments. Although the mechanisms of electron loss and production discussed in this paper seem to fit the experimental facts there might be others, of more or less complication, which would also be selfconsistent and would satisfy the tests used. Much more work is required, on world-wide results, before an explanation can be claimed to be unique. A.

551.510.535

7871. EFFECT OF THE SOLAR ECLIPSE ON THE LOWER PARTS OF THE IONOSPHERE AND THE GEOMAGNETIC FIELD. T.Nagata, Y.Nakata, T.Rikitake and I.Yokoyama. Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 121-35 (1955).

The changes in the electron density of the E-layer are examined in relation to the solar eclipse on May 9, 1948. It is found that the electron density decreases over a wide area, the maximum decrease amounting to about one half of the normal value of the electron density which it is supposed would have been observed if there were no eclipse. Having the maximum decrease at the centre of the eclipsed area, a roughly circular pattern of decrease spreads far beyond the boundary of the area of the optical eclipse. The change in the electrical conductivity integrated throughout the layer is also obtained from the above distribution. Under the assumptions that the solar daily variation of the geomagnetic field is caused by a uniform electric current flowing in the E-layer and that the distribution of the electrical conductivity is given as mentioned above, the changes in the distribution of the current as well as that of the magnetic field on the earth's surface are calculated. The agreement between the observed and calculated changes in the magnetic field is satisfactory not only in the magnitude but also in their time variations. So it may be suggested that the changes in the earth's magnetic field at the time of a solar eclipse are caused by the probable modification of the electric current which is responsible for the solar daily variation of the geomagnetic field. A.

551.510.535

7872. ON ANOMALOUS VARIATIONS OF CRITICAL FREQUENCIES AND VIRTUAL HEIGHTS OF THE F1 AND E REGIONS OF THE IONOSPHERE. T.Sato. Rep. Ionosphere Res. Japan, Vol. 9, No. 4, 205-14 (1955).

Latitudinal and seasonal variations of critical frequencies (foF1, foE) and virtual heights (h'F1, h'E) of the F1- and E-regions for years of high and low sunspot activities are investigated and anomalous variations are shown. These anomalies are analogous to those in the F2-region. The same method of explanation for anomalies as for those in the F2-region is used. A.

551.510.535 : 538.566.3

7873. HIGH LATITUDE IONOSPHERIC OBSERVATIONS USING EXTRA-TERRESTRIAL RADIO WAVES. C.G.Little. U.R.S.I. Inform. Bull., No. 94, 36-41 (Nov.-Dec., 1955).

The frequency of occurrence of strong ionospheric absorption (>10%) at 65 Mc/s has been determined in Alaska from intensity measurements of the extra-terrestrial radiowaves received by a fixed aerial system. The diurnal variation shows a maximum around noon and together with the day-to-day variation shows a good correlation with the occurrence of polar blackouts. It also exhibits a strong link with magnetic activity. Recordings of the scintillation of the intense localized radio sources show marked differences between the phenomena observed in England and Alaska. Scintillations were always observed when marked 65 Mc/s absorption occurred at the times of transit of the radio sources. G.M.Brown

551.510.535

7874. DETERMINATION OF IONOSPHERIC DRIFT VELOCITIES FROM THREE-RECEIVER FADING RECORDS. U.R.S.I. Inform. Bull., No. 95, 25-33 (Jan.-Feb., 1956).

General account of the procedure adopted at Cambridge in the analysis of fading records of a downcoming radiowave obtained at three stations separated by distances of the order of one wavelength. The following points are considered: Determination of mean time shifts, selection of reliable records, calculation of magnitude and direction of ionopsheric drift velocity, and conventions used in the presentation of results. G.M.Brown

551.510.535

7875. OBSERVATIONS AT CAMBRIDGE OF IONOSPHERIC DRIFTS AT POINTS SEPARATED BY 7.5 km. B.H.Briggs. U.R.S.I. Inform. Bull., No. 95, 33-5 (Jan.-Feb., 1956).

Preliminary account of experiments on 4 Mc/s in which

fading records were obtained simultaneously from a local transmitter and another situated 15 km to the west. Determination of the velocity of disturbances from time displacement measurements showed that, within the experimental error, the same values were obtained for two points separated by 7.5 km. G.M.Brown

551.521 : 551.51

7876. A DISCUSSION ON RADIATIVE BALANCE IN THE ATMOSPHERE.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 145-216 (1956).

A discussion held in June 1955 at which twelve papers were presented. These are abstracted individually.

551.521 : 551.51

7877. A DISCUSSION ON "RADIATIVE BALANCE": INTRODUCTORY REMARKS. H.S.W.Massey.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 145-8 (1956).

A detailed study of the atmospheric balance involves the collection of varied and complex physical data over a wide range of altitudes. Much can be done by rocket soundings. Recent observations up to 30 km using this technique have yielded results in good agreement with those found previously by balloon soundings; and an additional check is afforded by the internal consistency of observations of the three basic parameters: p, ρ, and T. Future work will aim at obtaining extensive data of this type over a range of altitudes sufficing for an adequate discussion of the problem of radiative equilibrium. D.R.Barber

551.521 : 551.51

7878. A DISCUSSION ON "RADIATIVE BALANCE": THE PATTERN OF RADIATIVE HEATING AND COOLING IN THE TROPOSPHERE AND LOWER STRATOSPHERE. F.Möller.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 148-56 (1956).

Meteorological effects of radiation from atmospheric constituents e.g. CO_2 and H_2O with strong i.r. absorptions in a cloudless atmosphere are profoundly modified by the presence of clouds, since the latter radiate like black bodies. It is probable also that atmospheric haze layers, even when so tenuous as to be invisible, play an important part in determining the radiative pattern of the lower atmosphere. Radiative conditions within the typical cloud; and the atmospheric radiation loss from an average cloudy sky, are discussed.
D.R.Barber

551.521 : 551.51

7879. A DISCUSSION ON"RADIATIVE BALANCE": THE COMPUTATION OF RADIATIVE HEATING RATES IN THE ATMOSPHERE. A.R.Curtis.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 156-9 (1956).

On the assumptions that (i), Kirchoff's law is valid; and (ii), the absorption band considered is that due to one atmospheric constituent only, the equation of radiative transfer is used to derive a formal expression for the rate of heating at any height in a plane-stratified atmosphere. Already the result has been used for an approximate computation for the 15μ band of CO_2; reliable numerical data by this method require the use of an electronic computor. D.R.Barber

551.521 : 551.51

7880. A DISCUSSION ON "RADIATIVE BALANCE": HIGH-RESOLUTION SPECTROSCOPY OF MINOR ATMOSPHERIC CONSTITUENTS. M.Migeotte.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 159-60 (1956).

The presence of atmospheric O_3 and N_2O is noted in the solar spectrum; and of fine structure (about 320 lines) in the 9.6μ band of O_3, and 102 lines in the 9 μ band of O_3. A new laboratory investigation of the 17 μ N_2O band has been completed recently (Lakshmi, Rao and Nielsen 1955).
D.R.Barber

551.521 : 551.51

7881. A DISCUSSION ON "RADIATIVE BALANCE": THE USE OF SURFACE OBSERVATIONS TO ESTIMATE THE LOCAL ENERGY BALANCE OF THE ATMOSPHERE. G.D.Robinson.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 160-71 (1956).

An estimate is made, based mainly on surface measurements, of the net radiation entering or leaving the system atmosphere plus surface layer of earth at Kew during the whole period May 1953 to April 1954, and for separate periods of three summer and three winter months. The heat liberated by phase changes of H_2O and the heat conduction from the system to the ground are also estimated. The deduced dynamical and advective heating is compared with the latitude means derived from similar world-wide studies, and from published studies of the meridional eddy flux of heat. In the course of this work new estimates are made of the local albedo for visual plus ultraviolet, infrared and total radiation, and of the photometric albedo. A.

551.521 : 551.51 : 523.77

7882. A DISCUSSION ON "RADIATIVE BALANCE": SOLAR INFRA-RED SPECTROSCOPY FROM HIGH-ALTITUDE AIRCRAFT. F.E.Jones and V.Roberts.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 171-5 (1956).

By means of air-borne spectrographs of suitable resolution in the far-infrared, operated at altitudes $\geq$ 30 000 ft, it is possible to reduce atmospheric H_2O and CO_2 absorption to such a low level that other band features are clearly revealed. The technique can yield new data in the normal gaps of the solar i.r. spectrum, particularly within the region of the great water-vapour band at 5.3-7.5 μ which should be seen in detail at heights around 50 000 ft. D.R.Barber

551.521 : 551.51

7883. A DISCUSSION ON "RADIATIVE BALANCE": SOME MEASUREMENTS OF THE FLUX OF INFRA-RED RADIATION IN THE ATMOSPHERE. A.W.Brewer and J.T.Houghton.
Proc. Roy. Soc. A, Vol. 236. No. 1205, 175-86 (1956).

For the continual development of the kinetic energy of the winds, it is necessary for the upper troposphere to be cooled by radiation. Results are reported of nine aircraft ascents on which the upward and downward flows of infrared radiation were measured and compared with values calculated using the radiation charts of Elsasser and Yamamoto. The divergence of radiative flux deduced from these measurements clearly shows that the cooling in the troposphere is not very different from that calculated from radiation charts. The importance of clouds on the radiative pattern is demonstrated; at the moment, incomplete knowledge of cloud structure will be the chief factor limiting the value of calculations of atmospheric radiation. The measurements are of very limited value in the stratosphere, since, for the very small quantities of water there, the effective radiation is in the rotation band of water vapour (λ between 30 and 70 μ) and the radiometer used was not sensitive to these wavelengths. If the use of radiation charts is extrapolated to these conditions they indicate that the radiative cooling continues in the lower stratosphere. This is in contrast with the "classical" view that the stratosphere is in radiative equilibrium. A.

551.521 : 551.51

7884. A DISCUSSION ON "RADIATIVE BALANCE": ORIGIN AND DISTRIBUTION OF THE POLYATOMIC MOLECULES IN THE ATMOSPHERE. G.M.B.Dobson.
Proc. Roy. Soc. A, Vol. 236, No. 1205, 187-93 (1956).

A discussion of recent results on the vertical distribution of water-vapour and ozone in the upper troposphere and lower stratosphere. In mid-latitudes a min. concentration of H_2O is found at about 15 km and a max. of O_3 at about 25 km. In the height-range, 10-15 km, there is thus an upward diffusion of H_2O and a downward diffusion of O_3, with markedly different lapse-rates. D.R.Barber

551.521 : 551.51

885. A DISCUSSION ON "RADIATIVE BALANCE": HERMAL RADIATION IN THE UPPER ATMOSPHERE. .R.Curtis and R.M.Goody.
roc. Roy. Soc. A, Vol. 236, No. 1205, 193-206 (1956).

Atmospheric radiation calculations usually assume a oltzmann distribution of molecules among the vibrational nd rotational energy levels. At the low pressures encoun-red high in the earth's atmosphere, the collision rate is nsufficient to maintain such a distribution. An equation of ransfer is derived, for a vibration-rotation band, which does ot assume a Boltzmann distribution among the vibrational evels. From this is derived an equation for the heating rate ue to the band in a plane-stratified atmosphere. It is shown hat the heating rate per unit mass tends to zero with the ressure, because of the departure from a Boltzmann distri-ution, which becomes serious above about 75 km. A method f solving the equation for the heating rate is described, and s applied to a model of the 15 μ carbon dioxide band as an xample. The effect of departures from a Boltzmann distri-ution among the rotational levels is also considered, and it s shown to be unimportant for vibration-rotation bands, but o limit computations on the water-vapour rotation band to eights less than about 90 km. A.

551.521 : 551.51

886. A DISCUSSION ON "RADIATIVE BALANCE": THE THERMOSPHERE. D.R.Bates.
roc. Roy. Soc. A, Vol. 236, No. 1205, 206-11 (1956).

The influence of thermal conductivity on the temperature istribution in the thermosphere is discussed. It is inferred hat the temperature gradient probably falls off rapidly above he base of the F_1 layer instead of remaining almost constant p to great altitudes, as is often assumed. The view that the emperature near the 250 km level is only about 800°K (as uggested by rocket and radio measurements) and the view hat the temperature in the exosphere is at least 1500°K (as leduced from the generally accepted theory of the escape of tmospheric helium) appear irreconcilable. A.

551.521 : 551.51

887. A DISCUSSION ON "RADIATIVE BALANCE": TUDY OF SOLAR RADIATION AT HIGH ALTITUDES USING ROCKET-BORNE INSTRUMENTS. R.L.F.Boyd.
roc. Roy. Soc. A, Vol. 236, No. 1205, 211-16 (1956).

A summary of the results obtained by means of rocket-orne photon-counters, thermo-luminescent phosphors, hotographic plates covered with filters of Be or Al foil, and hotographic or photoelectric quartz-spectrographs. Data on olar X-radiation, Lyman α-radiation, u.v. spectrum, and bsorption by atmospheric O_3 are included. D.R.Barber

551.521 : 551.51

888. A DISCUSSION ON "RADIATIVE BALANCE": BSORPTION OF ULTRA-VIOLET RADIATION BY THE TMOSPHERIC GASES. R.W.Ditchburn.
roc. Roy. Soc. A, Vol. 236, No. 1205, 216-26 (1956).

The order of magnitude of absorption coefficients for hoto-ionization and photo-dissociation continua and their elation to absorption lines and absorption bands are dis-ussed. Measurements and calculations of N_2, O_2, N, O nd O_3 are summarized and "depths of penetration" into he "model atmosphere" assumed by the Rocket Panel are iven. Absorption data for the minor atmospheric constituents re tabulated. The relation of absorption cross-section esults to theories of the ionosphere is briefly discussed. lassified references to experimental and theoretical data are iven. A.

551.521.3

889. MEASUREMENT OF ATMOSPHERIC ABSORPTION ON 9350 Mc/s BY UTILIZING SOLAR RADIO RADIATION. P.André, I.Kazes and J.L.Steinberg.
C.R. Acad. Sci. (Paris), Vol. 242, No. 17, 2099-101 (April 23, 1956). In French.

The progressive attenuation of solar radiation on 9350 Mc/s with increasing solar zenith distance has been measured, and the variation of observed atmospheric optical thicknesses compared with theoretical optical thicknesses calculated for absorption by atmospheric oxygen and water vapour. The observed optical thicknesses are systematically some 35%-50% greater than the theoretical ones. M.W.Ovenden

551.521.3

890. SKY LUMINANCE MEASUREMENTS. R.G.Hopkinson and P.Petherbridge.
J. Opt. Soc. Amer., Vol. 46, No. 7, 555-6 (July, 1956).

In an earlier report the ratio Bo/B90 (using Fritz's terminology) under the conditions of measurements was less than the average taken for normal snow-free temperature zone terrain, e.g. Bo/B90=3 in the formula for the C.I.E. Overcast Sky (Zurich 1955). The distribution of the luminance of the sky was not symmetrical about the measuring point but more uniform over western areas. The ratio for the western horizon was 1.6 and for the eastern horizon 2.3 as compared with 3 for the C.I.E. overcast sky. The reflectance of the snow cover itself was 0.8 but trees and other breaks reduce the average reflection of the terrain. To obtain close agreement between the western sky distribution and that from Fritz's formula the average reflection factor would have to be about 0.6. It was doubtful whether so low a value occurred but Fritz's treatment is partly confirmed. R.S.Read

551.521.3

891. ATMOSPHERIC TURBIDITY AND THE TRANSMISSION OF ULTRAVIOLET SUNLIGHT. D.Deirmendjian and Z.Sekera.
J. Opt. Soc. Amer., Vol. 46, No. 8, 565-71 (Aug., 1956).

Recent determinations of the solar ultraviolet spectrum made by various authors are examined and an attempt is made to explain the high transmission values found by some of these in terms of the forward scattering characteristic of Mie particles of a moderate refractive index. The Bouguer-Langley method used heretofore in the reduction of data, is shown to be more or less inaccurate in the determination of the solar ultraviolet from ground stations. It is claimed that the nature and quantity of some aerosol components can be successfully investigated by means of solar spectrophotometry provided the difference between the "observed" and theoretical optical thickness is carefully analysed in terms of the scattering by Mie particles and other non-Rayleigh scatterers permanently present in the atmosphere. A.

551.521.326

892. THE EXTINCTION OF THE LIGHT OF THE NIGHT SKY. I. G.Costantine and A.Hammad.
Astrophys. J., Vol. 124, No. 1, 298-301 (July, 1956).

The mathematical theory of the plane-parallel model of the scattering atmosphere with an emitting layer above it is being refined by making use of Chandrasekhar's recent work on radiative transfer. Thus exact expressions are derived for the intensity of the diffused light received at the ground for three forms of the emission from the layer. These exact expressions are less elaborate to evaluate than are the approximate expressions adopted by the previous investigators. Numerical comparison is then made between the exact and approximate solutions and questions of interest in connection with the nightglow are discussed in the light of the numerical results. A.

551.521.326

893. THE EXTINCTION OF THE LIGHT OF THE NIGHT SKY. II. G.Costantine and A.Hammad.
Astrophys. J., Vol. 124, No. 1, 302-6 (July, 1956).

This is a preliminary investigation on the effect of curvature on the values of the intensity of light received at the ground from an emitting layer that lies at a height h above the

ground. The intervening atmosphere is one of small optical thickness, in which absorption is negligible and scattering is isotropic. It is found by numerical calculation that curvature effects are negligible for moderate and high altitudes of observation. For low altitudes of observation, however, curvature leads to about a 7% rise in the values of the total intensity and thus cannot be neglected. A.

551.521.326 : 535.247.4

7894. RECORDING NIGHT SKY PHOTOMETER OF HIGH SPECTRAL PURITY. R.B.Dunn and E.R.Manring.
J. Opt. Soc. Amer., Vol. 46, No. 8, 572-7 (Aug., 1956).

A photometer which surveys the sky in 3 min 53 sec and possesses high spectral purity has been constructed and is in use at Sacramento Peak, New Mexico. The photometer is used to record the night sky emission lines at 5577, 5890 and 6300 A. It employs three interference filters 6 inches in diameter, of about 15 A bandwidth, of about 70% transmission, and centred upon the above emission lines. It also employs a single element quartz birefringent filter used to modulate the emission lines. This arrangement of filters was first employed by Blamont and Kastler (1951) and has been effectively used by Koomen et al. (1954). The a.c. signal in the photomultiplier is then proportional to the emission intensity. This combination of filters provides high spectral purity and corresponding freedom from the effects of continuum in the vicinity of the emission lines. A.

551.578.1 : 519.2

7895. THE FITTING OF A TRUNCATED LOG-NORMAL CURVE TO DAILY RAINFALL DATA. S.C.Das.
Austral. J. Phys., Vol. 9, No. 1, 151-5 (March, 1956).

Reference is made to an earlier paper in which two types of truncation were used to fit truncated type III curves to the Sydney daily rainfall data. In this case a log-normal curve is used for the daily rainfall data to see how good or bad the fit is compared with that from the type III curve. The calculation of the expected frequencies for testing the goodness of fit is tabled. The mean and standard deviation calculated directly from the sample agree well with those estimated on the basis of the type III curve, but deviate considerably from those estimated on the basis of the log-normal curve. It is concluded that when a certain proportion of days have zero rainfall, the better curve to use is the type III curve, not the log-normal, as previously assumed by several writers in meteorology.
R.S.Read

551.594.13

7896. DAILY VARIATIONS OF THE ELECTRICAL CONDUCTIVITY OF THE UPPER ATMOSPHERE AS DEDUCED FROM THE DAILY VARIATIONS OF GEOMAGNETISM. I. EQUATORIAL ZONE. H.Maeda.
Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 148-65 (1955).

Daily variations of the electrical conductivity of the upper atmosphere at the equatorial zone are discussed on the basis of rich material from Huancayo Observatory on daily magnetic variations by means of a method originated by M.Hasegawa (1950). The daily variations of the electric field and the zero level of the daily magnetic variations are also examined. The following results are especially of interest: (i) The night-time conductivity is about one tenth of the noon conductivity. (ii) While the ratio of the semi-diurnal amplitude to the diurnal is about one half in the observed magnetic variations at Huancayo, it is reduced to more or less one seventh in the calculated variation of the electric field. (iii) The zero level of the daily magnetic variations is lower than the daily mean value by about 45 per cent of the diurnal amplitude, consequently it may be suggested that the westward maximum current intensity near midnight is about one tenth of the eastward maximum intensity near noon in the case of S_q, but the former near sunset is about one fifth of the latter near noon in the case of S_q. A.

551.594.14

7897. RADON CONTENT OF THE ATMOSPHERE. W.Anderson and R.C.Turner.
Nature (London), Vol. 178, 203-4 (July 28, 1956).

A continuation of the work referred to in Abstr. 658 (1955). The radium contents of 10 samples of coal have been determined and are such that the release of radon from the burning of coal is not a likely source of the increased radon levels in smoky and fog conditions. Adsorption of radon on atmospheric dust nuclei appears not to occur, and the raised levels of activity are most likely explained in terms of the special meteorological conditions. L.E.Mussell

551.594.14

7898. RaD, RaE AND Po IN THE ATMOSPHERE. P.King, L.B.Lockhart, Jr, R.A.Baus, R.L.Patterson, Jr, H.Friedman and I.H.Blifford.
Nucleonics, Vol. 14, No. 6, 78, 80-3 (June, 1956).

Two methods of collection of natural radioactive products from the atmosphere were used; collection on filter paper in high capacity air filters and collection of batches of about 500 gallons of rainwater with subsequent concentration on $Al(OH)_3$ floc. Bi and Pb fractions were isolated from the samples and RaD measured by the build-up of RaE in the Pb fraction. Activities of samples from seven sites are listed. The rainwater activity from any one site varied widely from sample to sample, but the average activity of samples from an island site was 10 times less than those from inland sites.
R.D.Smith

551.594.14

7899. VARIATIONS OF THE NATURAL RADIOACTIVITY OF THE AIR, MEASUREMENTS AT 2600m ABOVE SEA-LEVEL IN THE NORTH ALPS. R.Reiter.
Z. Naturforsch., Vol. 11a, No. 5, 411-18 (1956). In German.

On the Zugspitzplatt measurements have shown that the natural activity varies by a factor of up to 9.5 when the wind is between the SE and SW compared with that from other directions. This has been correlated with the geology of the terrain the wind has passed over. There was no correlation between radioactivity and atmospheric pressure but extreme values tended to occur when the relative humidity was greater than 80%. The electrical conductivity of the air was affected by the changing radioactivity. J.M.Hough

551.594.21

7900. THE RELATION BETWEEN A FIELD OF RELATIVE DIVERGENCE AND THE OCCURRENCE OF THUNDERSTORMS. F.Rein.
Czech. J. Phys., Vol. 5, No. 4, 549-50 (Dec., 1955).

The relative divergence has been calculated by the method of Sawyer and Matthewman (Quart. J. Roy. Meteorol. Soc., Vol. 77, 667, Oct., 1951) for 12 thunderstorms between the 500-1000 mb levels. It is found that convergence of the field is correlated with the occurrence of thunderstorms.
J.M.Hough

551.594.21

7901. A THEORY OF THUNDERCLOUD ELECTRICITY. C.T.R.Wilson.
Proc. Roy. Soc. A, Vol. 236, No. 1206, 297-317 (Aug. 2, 1956)

The thundercloud is regarded as a great influence machine the ionization currents associated with it being the agents by which its electromotive force is developed and maintained. The moving ions which constitute these currents may be intercepted by solid or liquid cloud elements so that it becomes possible form them to be carried against the field and so increase an existing electromotive force. The early stages in its growth are due to the ionization current within the cloud initiated by the earth's fine-weather field. Later it is the external current due to the thundercloud's own field which are effective. Lightning discharges may themselves contribute to the electromotive force of the thundercloud. A.

551.594.5

02. AUTOMATIC AURORAL RECORDER. D.M.Hunten.
Opt. Soc. Amer., Vol. 46, No. 8, 578-83 (Aug., 1956).

A description is given of a device which automatically weeps the meridian once each five minutes and records the tensity of the auroral green line (5577 A) in each 10^0 step. is almost completely insensitive to white light, but produces warning signal if the white light becomes very bright. The esponse is roughly logarithmic over a range of 10 000 to 1 in ntensity. The intensities are recorded directly and also in igital form. For the latter, five steps of intensity are distinuished and punched in paper tape; each step corresponds to a ictor of 10 and the scale agrees fairly closely with the accepd International Brightness Coefficients. A.

551.594.5

903. CHARACTERISTICS OF AURORAS CAUSED BY NGULAR DISPERSED PROTONS. A.Omholt.
atmos. terrest. Phys, Vol. 9, No. 1, 18-27 (July, 1956).

Chamberlain's proposal that auroral arcs are caused by onoenergetic protons with a certain dispersion in direction is onsidered. Calculations are carried out on the luminosity urves of the main auroral features and of the Balmer lines, nd on the Doppler profile of these latter viewed in the direcon of the magnetic horizon. For the main features the comuted luminosity curves are in moderate accord with the oberved. Reliable observations are lacking in the case of the almer lines. According to the calculations, these lines should ecome narrower as the altitude within an aurora is decreased. he computed profiles are not in agreement with the observed, nless the recorded light originated from the lowest part of ach of the auroras studied. A.

551.594.6

904. LOW-FREQUENCY RADIOWAVE NOISE OF THE ARTH'S MAGNETIC FIELD. R.Benoit.
.R. Acad. Sci. (Paris), Vol. 242, No. 21, 2534-5 (May 23, 956). In French.

Tests were carried out at Béni-Abbès confirmed that the noise was not continuous but consisted of very brief uninterrupted impulses of wide spectral range evidently produced by atmospherics. A filter was used to eliminate frequencies above 1000 c/s and an amplification of 10^4 was employed. An example is given of the registrations obtained at minute intervals. Little is evident in the band 10-100 c/s. The tests lasted over a period of 10 days. It is concluded that either a period of exceptional calm existed during the tests, or the noise is a little less uniquely caused by impulses due to atmospherics, or both cases exist. The results confirm the theory developed by Grenet. R.S.Read

551.594.6

7905. ELECTROMAGNETIC PHENOMENA OF NATURAL ORIGIN IN THE 1.0-150 c/s BAND. P.A.Goldberg.
Nature (London), Vol. 177, 1219-20 (June 30, 1956).

To determine characteristics of natural activity at low audio and sub-audio frequencies, observations of geo-electromagnetic activity in the 1.0-150 c/s band were made at an isolated place in eastern Oregon. The activity was found to be due to disturbances almost wholly of a burst-like form. Both the north–south and vertical magnetic components were similar as regards rate and duration of bursts, the magnitude being of the order of 10^{-8} gauss and the rate about 20 bursts/sec, although for the north–south component the magnitude is about 3×10^{-7} gauss. A highly regular and diurnal nature of the variation of activity is indicated, but with minor differences from day to day. The principal minimum occurs at 0700 hr L.M.T. and a secondary at 2100-2200 hr. A very strong major maximum occurs at 1400-1600 hr and a minor maximum at 2300-0100 hr. The burst character of these disturbances is suggestive of atmospherics due to lightning activity. The form of the curve giving the diurnal variation indicates that for the daytime ionosphere the lowest level of ionization affecting very low-frequency propagation between points on the sunlit hemisphere begins to be effective about two hours after ground sunrise. R.S.Read

BIOLOGY 57/59

578.087.8

906. MEASUREMENT OF BODY RADIOACTIVITY.
.W.Reed.
ature (London), Vol. 178, 172-5 (July 28, 1956).

Brief report of a conference held at Leeds, April 16, 17 1956).

578.088.2

907. COMMENTS ON A RECENT PAPER BY HUETER ET AL. ON ULTRASONIC LESIONS IN THE CENTRAL NERVOUS YSTEM. W.J.Fry.
. Acoust. Soc. Amer., Vol. 28, No. 4, 719-21 (July, 1956).

A critical analysis of the Hueter paper (see Abstr. 4125/ 1956). Some of the more important points discussed are: 1) The unique advantages of producing ultrasonic lesions in he brain by using dosages appropriate for selective action combined with focusing of the beam in contrast to the use of ocusing alone. (2) The choice of an irradiation procedure in experiments designed for the elucidation of physical mechanisms of the action of ultrasound on tissue. (3) The specification of the acoustic variables required for a dosage description. (4) The inapplicability of Eyring's theory of viscosity, plasticity, and diffusion to the elucidation of observed dosage relations. (5) The clarification of the usage of the terminology, nontemperature effects. (6) The applicability of the reciprocity method for the calibration of thermocouple probes. A.

MEDICAL SCIENCE. HUMAN PHYSIOLOGY 61

612.171.1

7908. AURAL ELECTROCARDIOGRAMS. A.Gemant, D.C.Burch and E.B.Miller.
Rev. sci. Instrum., Vol. 27, No. 6, 400-1 (June, 1956).

In heart surgery the need arises for electrocardiograms that would not require visual attention. This aim has been achieved by converting the voltage wave pattern into a sound pattern of varying pitch; the latter is an exact reproduction of the voltage wave. The apparatus used for the conversion is described. Its performance on humans as subjects was found satisfactory. A.

612.843.32

7909. NEUTRAL POINTS IN 138 PROTANOPES AND DEUTERANOPES. G.L.Walls and G.G.Heath.
J. Opt. Soc. Amer., Vol. 46, No. 8, 640-9 (Aug., 1956).

Neutral points have been found by means of a rotary mixer and Munsell papers, minimizing any dispersion of individual values by individual ocular pigmentations. Determined thus, the Illuminant C values for 39 new (post-Walls-Matthews) protanopes covered a range of 3.7 mμ with the mean at 492.3 mμ, those for 38 new deuteranopes a range of 5.8 mμ with the mean at 498.4 mμ. Illuminant D values for 13 additional protanopes covered a range of only 3.3 mμ with the mean

at 490.3 mμ, those for 15 recent deuteranopes a range of only 5.1 mμ with the mean at 496.2 mμ. The intergroup gap, observed earlier by Walls and Mathews and also here with "C" values, is clearly genuine so that it is possible to diagnose protanopia and deuteranopia differentially from the neutral-point measurement alone (contrary to universal belief). Evidence is presented that Illuminant D is certainly not "too blue" to be considered a physiological white standard, and that by comparison Illuminant C is really yellowish, so that Illuminant D is the better of the two to use in physiological investigations. This supports the earlier conclusion of Walls and Mathews based on colour-normal subjects. A.

612.843.613

7910. RETINAL NOISE AND ABSOLUTE THRESHOLD. H.B.Barlow.
J. Opt. Soc. Amer., Vol. 46, No. 8, 634-9 (Aug., 1956).

It is shown that the absorption of one quantum can excite a rod in the human retina, but that at least two, and probably many more, excited rods are needed to give a sensation of light. It is suggested that noise in the optic pathway limits its sensitivity, and this idea is subjected to an experimental test. The hypothesis is then formulated quantitatively, and shown to be able to account for the above experiment, and also the disagreement in the literature between those who believe that the absorption of two quanta can cause a sensation, and those who believe that 5 or more are required. The formulation of the hypothesis is used to calculate the maximum allowable noise (expressed as a number x of random, independent events confusable with the absorption of a quantum of light) in the optic pathway for the absorption of various fractions of the total number of quanta incident at the cornea. A.

612.843.615

7911. GLARE DISCOMFORT AND PUPIL DIAMETER. R.G.Hopkinson.
J. Opt. Soc. Amer., Vol. 46, No. 8, 649-56 (Aug., 1956).

A limited study has shown that the diameter of the pupil of the eye is not related directly to the sensation of discomfort which results from a bright light source in the field of view. Other factors, especially the illumination received at the eye, govern the pupil diameter. The more concentrated the source producing the illumination at the eye, the greater the contraction of the pupil. When the eye is subjected to intolerable glare, the pupil not only contracts, but varies in diameter, dilating and contracting irregularly every few seconds. The study indicates that the pupil diameter by itself cannot be used as an objective indicator of the degree of glare discomfort. A.

612.843.7

7912. RECOGNITION OF FORMS AGAINST A COMPLEX BACKGROUND. R.M.Boynton and W.R.Bush.
J. Opt. Soc. Amer., Vol. 46, No. 9, 758-64 (Sept., 1956).

Although many visual tasks require the observer to search for and attempt to recognize one of a particular class of objects of interest, the problem has received little systematic investigation. Basic visibility data, based upon known shapes presented in known positions, certainly do not apply. In this experiment, observers were repeatedly presented with a background array of curvilinear forms, among which a "critical target" was present 50% of the time. The critical targets consisted of one or another of five examples of six geometrical forms, all with straight sides and sharp corners, any one of which was equally likely to appear in any part of the visual field. Probability of correct recognition was determined as a function of the number of background forms, viewing time, visual angle, and form density. Forms were selected on the basis of a preliminary experiment in which basic recognition data were gathered on 240 different forms. A.

612.85

7913. CURRENT STATUS OF THEORIES OF HEARING. G.v.Békésy.
Science, Vol. 123, 779-83 (May 4, 1956).

The paper summarizes the present position in regard to the theories of hearing. It is shown that each of the vibration patterns of the basilar membrane of the ear postulated by the four major theories (resonance, telephone, travelling waves, standing waves) can be obtained by varying two elastic properties of the membrane — the coupling between adjacent parts and the absolute value of the elasticity. If these two variables are adjusted to their numerical values in the cochlea of a living animal or a fresh preparation of the human ear, travelling waves are observed along the membrane. These travelling waves have a flat maximum which shifts its location along the membrane with a change of frequency — the place of the maximum determines the pitch. An enlarged model of the cochlea in which the nerve supply of the sensory organs on the basilar membrane was replaced by the skin of the arm indicates that the inhibitory action in the nervous system can produce quite sharp local sensations, which shift their place with changes in the frequency of the vibrations — suppressing all sensation except on a small spot near the maximal amplitude of vibration. In the ear the situation seems to be the same because, there too, two cycles of a tone are enough to enable the observer to discriminate the pitch of the tone. A.B.Wood

612.858.7

7914. IMPLICATION FOR AUDITORY THEORY OF UNITARY PITCH PERCEPTION DESPITE DIPLACUSIS. L.H.van der Tweel.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 718 (July, 1956).

Licklider's triplex theory of auditory frequency analysis (3rd Conference on Information Theory, London, 1955) may have overlooked the fact that judgment of pitch may depend on whether the subject uses either or both ears. One sinusoid presented to both (unequal) ears gives rise to a single intermediate pitch, implying comparison of the signals of both ears before judgment of the pitch is made. J.B.Arthur

612.858.7

7915. COMMENT ON VAN DER TWEEL'S SUGGESTION CONCERNING THE IMPLICATION OF DIPLACUSIS FOR AUDITORY THEORY. J.C.R.Licklider.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 718 (July, 1956).

Shows that van der Tweel's comments (preceding abstract) are not incompatible with the triplex theory. J.B.Arthur

612.858.751

7916. EFFECT OF LARGE INTERAURAL TIME DIFFERENCES UPON THE JUDGMENT OF SIDEDNESS. H.C.Blodget, W.A.Wilbanks and L.A.Jeffress.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 639-43 (July, 1956).

The maximal interaural time difference that could be introduced into one channel without loss of sidedness was determined for various noise bands. Through the presentation of stimuli by several methods it was found that time values vary with frequency of the noise bands, being greater for lower bands. Marked intersubject differences were found. For the lowest and most effective band used (106-212~), time ranged from 7.5 to 20.6 msec. A.

614.892

7917. NOISE BANDS VERSUS PURE TONES AS STIMULI IN MEASURING THE ACOUSTIC ATTENUATION OF EAR PROTECTIVE DEVICES. J.C.Webster, P.O.Thompson and H.R.Beitscher.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 631-8 (July, 1956).

The sound-exclusion properties (acoustic attenuation) of various earphones and ear defenders and combinations thereof were determined by the binaural, free-field, absolute-threshold-shift technique with the psychophysical method of adjustment. The earphones included dynamic earphones in two different sockets and hearing-aid-type receivers with individually moulded inserts. The ear defenders included certain con

ntional and newly developed earplugs and muffs, and a hard-elled noise-exclusion helmet. In a preliminary evaluation a limited number of devices, both tones and noise bands re used as stimuli, and comparative results are shown. In aluating the effectiveness of some of the newer devices, ise bands alone were used. For the exclusion of external und, particularly that below 1200 c/s, the order of merit r earphone combinations was: (1) large volume muffs with sert phones; (2) helmet with insert phones; (3) semiplastic ckets with dynamic phones; and (4) helmet with dynamic ones. The best combination provided the following amounts attenuation in the seven octave bands from 75 to 9600 c/s: 14, , 28, 33, 38, 44 and 40. A.

614.898

7918. ESSENTIAL REDUCTION IN THE TOLERANCE DOSE RECOMMENDED BY THE INTERNATIONAL COMMITTEE FOR RADIOLOGICAL PROTECTION. P.O.Robert.
C.R. Acad. Sci (Paris), Vol. 242, No. 26, 3134-7 (June 26, 1956). In French.

Radiation received at the "tolerance" rate over a 30-year period is sufficient (450 r) to become a genetical hazard and to reduce life span by an estimated 3-8 years. This dose received in 24 hours would be 50% lethal. It is recommended that for radiation workers, the present "tolerance" dose rate be retained, but that the cumulative dose should not exceed 5 r per year. For the general population, this should be reduced to 0.5 r per year. D.V.Mabbs

TECHNIQUE. MATERIALS 62/69

PHOTOGRAPHY 77

771.319 : 778.37

919. A MULTIPLE SPARK CAMERA FOR DYNAMIC RESS ANALYSIS. D.G.Christie.
photogr. Sci., Vol. 3, No. 5, 153-9 (Sept.-Oct., 1955).

A detailed description is given of a Cranz–Schardin type multiple spark camera capable of taking a series of nine ctures at a rate variable from 20 000 to 200 000 frames per cond. The application of the camera to the problems of acture and dynamic stress analysis is also described. A.

771.35

920. MULTILAYER SYSTEMS: ANTIREFLECTING YSTEMS, HIGH-REFLECTING STACKS AND INTERFERNCE FILTERS. O.S.Heavens.
photogr. Sci., Vol. 4, No. 1, 21-4 (Jan.-Feb., 1956).

The properties of three multilayer systems which are of otential importance in scientific photography are examined. ntireflecting systems of one and two layers are considered d the conditions under which single-layer blooming is likely be inadequate are mentioned. The use of multilayer stacks quarter-wave layers as an alternative to the semi-transrent metal film is discussed. Finally the properties of terference filters are compared with those of dye filters. oth silver + dielectric and all-dielectric interference filters e considered. A.

771.534/.535

921. THE PHOTOGRAPHIC ACTION OF IONIZING PARICLES. I. THE FORM OF THE BLACKENING CURVE FOR HOTOGRAPHIC FILM EXPOSED TO RADIATION.
.L.Kartuzhanskiĭ.
h. éksper. teor. Fiz., Vol. 29, No. 4(10), 516-28 (1955). In ussian. English translation in: Soviet Physics JETP (New ork), Vol. 2, No. 3, 550-8 (May, 1956).

The form of the curve expressing the blackening density an irradiated photographic film is investigated as a function the exposure. The data obtained for films of various sensivity and for various types of radiation, as well as the data oncerning the effect of supplementary exposure, are used to etermine the degree of dispersion of the latent image. A.

771.534

922. VARIATION IN CONTRAST OF PHOTOGRAPHIC MULSIONS IN THE ULTRA-VIOLET. R.J.King.
photogr. Sci., Vol. 3, No. 5, 150-2 (Sept.-Oct., 1955).

The measurement of γ of photographic plates in the ultraiolet at wavelengths between 2500 A and 3100 A is described, alibration being effected by means of a rhodium stepped edge or a rotating stepped sector. Under the conditions used, no intermittency effect was detected with the sector. The minimum contrast of certain plates at approximately 3100 A is shown to be due to strong absorption of the "emulsion base" in this spectral region. The variation of γ with the angle of incidence of the radiation is discussed. A.

771.534.55

7923. DETECTION AND RECOGNITION OF PHOTOGRAPHIC DETAIL. I. EMPIRICAL DATA APPLICABLE TO THE PREDICTION OF PERFORMANCE OF DIFFRACTION LIMITED SYSTEMS. D.E.Macdonald and J.T.Watson.
J. Opt. Soc. Amer., Vol. 46, No. 9, 715-20 (Sept., 1956).

Empirical data on visual detection and recognition of photographic detail as recorded on the photographic negative are presented in terms of sizes and contrasts in the object space. The performance of diffraction limited systems is given for five emulsions. A.

771.534.55

7924. RELATIONSHIP BETWEEN DEFINITION AND RESOLVING POWER WITH TEST OBJECTS DIFFERING IN CONTRAST. G.C.Higgins, R.N.Wolfe and R.L.Lamberts.
J. Opt. Soc. Amer., Vol. 46, No. 9, 752-4 (Sept., 1956).

It has been shown previously that the resolving power of a particular photographic system for a test object having a high contrast is not a unique measure of the subjectively determined definition of pictures made with the system. This work is extended to include the case where the resolving power of the negative as used in the system is determined with both a high-contrast and a low-contrast test object. The low-contrast resolving-power values do not correlate significantly better with definition than the high-contrast values and neither give a unique measure of definition. Thus the generalization that low-contrast resolving power is a unique measure of definition is not justified. A.

771.535

7925. ON THE DISPERSION OF THE LATENT IMAGE IN THE GRAINS OF NUCLEAR EMULSIONS. P.Cuer and R.Schmitt.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2831-4 (June 11, 1956). In French.

Experiments have been carried out to try and distinguish between the hypothesis of internal and external images and that of a variable dispersion of the surface image on the grains of nuclear emulsions. It is shown that only the latter plays an important role. A notable difference following post-exposure to inactinic infrared wavelengths is reported and interpreted. D.J.A.Prowse

771.535

7926. MOTION OF ELECTRONS AND HOLES IN PHOTOGRAPHIC EMULSION GRAINS. J.F.Hamilton, F.A.Hamm and L.E.Brady.
J. appl. Phys., Vol. 27, No. 8, 874-85 (Aug., 1956).

The use of simultaneous pulses of light and voltage to study the motion of electrons and holes in photographic grains and the role played by these charge carriers in the formation of the latent image is discussed. The electric field displacement of conduction electrons forming print-out as well as latent-image silver is shown by electron micrographs of the grains. Also, results on the motion of positive holes are presented. It is possible to show at the print-out level that this carrier is mobile; although it may be that the hole is displaced at the latent-image level, this behaviour has not been demonstrated. The light and voltage pulses used for the exposures are analysed and related to electron displacement. Indications are that when electrons are forced to the grain surface by an electric field, they are trapped in a time less than 1 μsec.

A.

778.33

7927. HIGH-RESOLUTION MICRORADIOGRAPHY USING LOW-VOLTAGE X-RAYS. A.Engström and R.C.Greulich.
J. appl. Phys., Vol. 27, No. 7, 758-9 (July, 1956).

Mathematical considerations of the concept of extremely high resolution in microradiography have allowed the deviation of optimal conditions for studies of biological material. Specimen thickness must be kept below 4 microns, and as a consequence very low voltages over the X-ray tube are needed. Using a special method for preparing the specimen for analysis, it has been possible to obtain microradiograms at X-ray potentials of a few hundred volts. The absolute resolution of the X-ray image is comparable to that of the light microscope.

A.

778.33

7928. THE FACTORS INVOLVED IN AN ASSESSMENT OF RADIOGRAPHIC DEFINITION. R.Halmshaw.
J. photogr. Sci., Vol. 3, No. 6, 161-8 (Nov.-Dec., 1955).

778.34

7929. A NEW METHOD ON INFRARED PHOTOGRAPHY. T.Suga and K.Yosihara.
Sci. of Light (Tokyo), Vol. 4, No. 1, 1-6 (Aug., 1955).

As the ordinary method of taking infrared photographs becomes useless at wavelengths greater than 1.4 μ, Czerny invented in 1929 an interesting method applicable to radiation o any wavelength. The authors found another method which is based on a principle different from Czerny's. A thin membra is blackened on one side with metal black, and the space on t other side is filled with aerosol. Parts of the membrane whe the radiation impinges are warmed up, so that the particles o the aerosol cannot approach there. Thus the image of a body be photographed is formed on the membrane. This image ca be made clearer by a developing process. By this method ab sorption spectra of some organic liquids were obtained. The sensitivity is practically the same as that of ordinary thermo piles. The definition of the image is at present inferior to th by Czerny's method.

A

778.3

7930. EFFECT OF HYPO CONCENTRATION ON THE CLEARING TIME OF THICK EMULSIONS. Y.Prakash.
Indian J. Phys., Vol. 29, No. 12, 569-72 (Dec., 1955).

The variation in clearing time for different concentratio of hypo has been studied for emulsion plates of thickness, 50 100, 200 and 400 microns at two different temperatures. A tentative explanation has been sought by considering the vari ous effects on the diffusion velocity of hypo. The results in dicate that 35% is the optimum value of hypo concentration for the clearing time for these plates.

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778.3

7931. AN AUTOMATIC DEVICE FOR FIXING THICK NUCLEAR EMULSION LAYERS. G.Thuro.
J. sci. Instrum., Vol. 33, No. 8, 296-8 (Aug., 1956).

A simple device has been constructed which keeps the fixer flowing first one way and then the other through the box in which the emulsion layers are placed. The flow of the fixe can be made as slow as required which is specially useful fo continuous dilution of the fixer. The fixer runs from one flas through the box, into another flask, and back, being driven b the pressure of the water mains. The direction of flow is automatically reversed by an electromagnetic switch, when t water in one of the flasks makes contact between a pair of electrodes.

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